

**VIRUDHUNAGAR S.VELLAICHAMY NADAR POLYTECHNIC COLLEGE**  
**(AUTONOMOUS),**  
(Affiliated to Directorate of Technical Education, Chennai – 25)  
VIRUDHUNAGAR – 626 001.

**SYLLABUS**  
**DIPLOMA IN MECHANICAL ENGINEERING**

**N1 – SCHEME**  
(2019-2020 onwards)  
**OUTCOME BASED EDUCATION**



**Head of the Department**

**Principal**

## **N1 - SCHEME**

### **Regulations [MPEC SYSTEM]**

### **(Implemented from 2019-2020)**

### **Diploma Courses in Engineering / Technology/ Commerce**

#### **1. Autonomy and Multi Point Entry and Credit System:**

As per G.O Ms 1136 dated 20.11.92 our Institution has been granted Autonomous status from the academic year 1994–95.

The Students admitted for the I Term Engineering at this Institution in Multi Point Entry Credit System (MPEC) will study under Autonomous pattern.

#### **2. Condition for Admission:**

Condition for admission to the Diploma Courses shall be required to have passed in the S.S.L.C. Examination of the Board of Secondary Education, Tamil Nadu.

(Or)

The Anglo Indian High School Examination with eligibility for Higher Secondary Course in Tamil Nadu.

(Or)

The Matriculation Examination of Tamil Nadu.

(Or)

Any other Examination recognized as equivalent to the above by the Board of Secondary Education, Tamil Nadu.

**Note:** In addition, at the time of admission the candidate will have to satisfy certain minimum requirements, which may be prescribed from time to time.

#### **3. Admission to Second year (Lateral Entry):**

A pass in HSC (Academic) or (Vocational) Courses mentioned in the Higher Secondary Schools in Tamil Nadu affiliated to the Tamil Nadu Higher Secondary Board with eligibility for University Courses of study or equivalent examination and should have studied the following subjects.

Sl. No.	Courses	H.Sc. Academic	H.Sc. Vocational	
		Subjects Studied	Subjects Studied	
			Related Subjects	Vocational Subjects
1.	All the Regular Diploma Courses	Physics, Chemistry & Mathematics/Biology (Botony and Zoology)	Maths / Physics / Chemistry	Related Vocational Subjects Theory & Practical
2.	Diploma Course in Modern Office Practice	English & Accountancy English & Elements of Economics English & Elements of Commerce	English & Accountancy, English & Elements of Economics, English & Management Principles & Techniques, English & Typewriting	Accountancy & Auditing, Banking, Business Management, Co-operative Management International Trade, Marketing & Salesmanship, Insurance & Material Management, Office Secretary ship.

- For the diploma programmes related with Engineering/Technology, the related / alternate courses prescribed along with Practical may also be taken for arriving the eligibility.
- Programme will be allotted according to merit through counseling by the Principal as per communal reservation.
- *Candidates who have studied Commerce Subjects are not eligible for Engineering Diploma Courses.*

**4. Age Limit : No Age Limit**

**5. Medium of Instruction : English**

#### **6. Courses of Study and Curriculum Outline:**

The Courses of study shall be in accordance with the curriculum prescribed by the Autonomous Academic Board from time to time, both in Theory and Practical. The curriculum outline is given in Annexure-I.

#### **7. Description of the Programme:**

The Programme for the Full Time Diploma in Engineering & Technology / MOP shall extend over a period of three academic years, consisting of six terms. Each Term will have 15 weeks duration of study.

The Curriculum for all the Six Terms of Diploma Programme have been revised and revised curriculum is applicable for the candidates admitted from 2019–2020 academic year onwards.

#### **8. Requirements of Examination and Attendance:**

The Examination shall be conducted at the end of each term by the Autonomous body affiliated to the State Board of Technical Education and Training, Tamilnadu.

A Candidate will be permitted to appear for the Autonomous End Examinations only if he/she secures minimum 80% of attendance in the term concerned.

If the candidate does not appear for at least one of the regular courses in the End Examination, he/she has to attend the same term in the next academic year.

#### **9. Eligibility for the Award of Diploma:**

No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed programme of study for a period of not less than **three academic years** in the Institution, when joined in First Year and **two academic years** if joined under Lateral Entry scheme in the second year and passed the prescribed examination. The minimum and maximum periods for completion of Diploma Programme are as given below.

<b>Diploma Courses</b>	<b>Minimum Period</b>	<b>Maximum Period</b>
<b>Full Time</b>	<b>3 Years</b>	<b>6 Years</b>
<b>Full Time (Lateral Entry)</b>	<b>2 Years</b>	<b>5 Years</b>

#### **10. Autonomous End Examinations:**

Autonomous End Examinations in all Programme of all the terms under the scheme of examinations will be conducted at the end of each term both in theory and practical. The internal assessment marks for all the courses will be awarded on the basis of continuous internal assessment earned during the term concerned. For each course, 25 Marks are allotted for internal assessment and 75 Marks are allotted for End Examination.

## 11. Continuous Internal Assessment:

### D) THEORY

The Continuous Internal assessment marks for a total of 25 Marks, which are to be distributed as follows:

Test	-	10 Marks
Assignment / Drawing Plate	-	10 Marks
Course Attendance	-	5 Marks
		-----
<b>Total</b>		<b>25 Marks</b>
		-----

#### (i) Test

**10 Marks**

Two Periodical Tests each of two hours duration for total of 50 Marks each and Model Examination for three hours duration for 75 Marks are to be conducted. The average of two periodical tests (PT) is to be taken for 5 Marks and Model Exam to be taken for another 5 marks. The periodical test mark and model exam marks are to be converted to five marks and awarded with the next higher integer if there is any fraction.

Total test marks (5 + 5) = 10 Marks

TEST	SYLLABUS	MAXIMUM MARKS	DURATION	WHEN TO CONDUCT
Periodical Test – I	I & II Unit	50	2 Hrs.	30 working days from Reopening
Periodical Test – II	III & IV Unit	50	2 Hrs.	30 working days from first periodical test
Model Exam	All Units	75	3 Hrs.	After last working day

#### (a) [i] Question Paper Pattern for Periodical Test – I & Test – II (First Year)

##### With No Choice

Part – A	4 Questions x 2 Marks	-	8 Marks
Part – B	4 Questions x 3 Marks	-	12 Marks
Part – C	6 Questions x 5 Marks	-	30 Marks
			-----
		Total	50 Marks
			-----

#### [ii] Question Paper Pattern for Periodical Test – I & Test – II (Engineering)

##### With No Choice:

Part – A	4 Questions x 2 Marks	-	8 Marks
Part – B	4 Questions x 3 Marks	-	12 Marks
Part – C	3 Questions x 10 Marks	-	30 Marks
			-----
		Total	50 Marks
			-----

**[iii] Question Paper Pattern for Periodical Test – I & Test – II (Modern Office Practice)**

**With No Choice:**

Part – A	4 Questions x 5 Marks	-	20 Marks
Part – B	2 Questions x 15 Marks	-	30 Marks
			-----
		Total	50 Marks
			-----

**(b) Question Paper Pattern for Model Exam: (First Year, Engineering & Modern Office Practice)**

As per Syllabus Book

**(ii) Assignment 10 Marks**

For each course, three Assignments are to be given each for 10 Marks and the total marks scored should be converted to 10 Marks and awarded with the next higher integer if there is any fraction.

**(iii) Course Attendance 5 Marks**

Award of marks for course attendance to each Theory / Practical Course / Project Work and Seminar will be as per the range given below.

**Attendance mark reference table**

<b>Range of Attendance (%)</b>	<b>Marks</b>
80% - 83%	1
84% - 87%	2
88% - 91%	3
92% - 95%	4
96% - 100%	5

**(iv) Total**

The Attendance (5 Marks), Assignment (10 Marks) & Test Marks (10 Marks) should be added and the Continuous Internal assessment marks for a total of 25 Marks is arrived.

**II) PRACTICAL / DRAWING**

The internal assessment mark calculation for Practical courses is given as follows:-

a) Observation and Exercise	:	10 Marks
b) Model Practical Examination	:	10 Marks
c) Attendance	:	5 Marks
		-----
Total	:	25 Marks
		-----

- After completion of each exercise, record should be submitted in the subsequent practical classes and marks awarded for observation should be carried over to record.
- The mark should be awarded for 10 in each exercise.
- The students have to submit the duly signed Bonafide record note book / file during the End Practical Examinations.
- All the experiments indicated in the syllabus should be completed and the same be given for final End Examinations.

**Note:** All the marks awarded for Assignments, Tests and Attendance should be entered in the course file / log book of the staff, who is handling the course. This is applicable to both Theory and Practical courses.

## **For Drawing**

For drawing courses, 20 Marks should be awarded for each drawing plate. The total of all drawing plate marks should be converted to 10 marks and awarded with the next higher integer if there is any fraction.

### **12. Project Work and Seminar:**

The students of all the Diploma Programmes have to do a Project Work and Seminar as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamilnadu.

In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects in department, institution wise, region wise and state wise. The selection of Project Work should be taken up in V Term of study.

**The Project may be reviewed twice during 4<sup>th</sup> and 10<sup>th</sup> week of VI Term.**

#### **a) Internal assessment marks for Project Work and Seminar:**

Project Review I & II (VI Term) (5+5)	:	10 Marks
Seminar I & II (5+5)/2	:	5 Marks
Project report	:	5 Marks
Attendance (Award of marks same as course pattern)	:	5 Marks
		-----
TOTAL	:	25 Marks
		-----

#### **b) Mark Allocation for Project Work and Seminar in End Examination:**

Viva Voce	:	25 Marks
Demonstration / Presentation	:	50 Marks
(The following Criteria components to be considered- Relevance of topic, Knowledge of methodology, Role of individual in the team, finding the Study etc.)		-----
TOTAL	:	75 Marks
		-----

A neatly prepared **PROJECT REPORT** as per the format has to be submitted by individual student during the Project work and seminar End Examination.

Selection of seminar topics should be based on Professional Ethics, Environmental Engineering and Management.

Proper record is **to be maintained for the two project reviews & seminars** and it should be preserved for two terms.

### **13. Academic Audit:**

All Test Papers and assignment note books after getting the signature with date from the students must be kept in the safe custody in the Department for verification and audit for two terms.

### **14. Criteria for pass:**

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed programme of study successfully and pass all the courses prescribed in the curriculum.

2. A candidate shall be declared to have passed the examination in a course if he/she secures not less than 40% in Theory courses and 50% in Practical courses out of the total prescribed maximum marks including both the Internal Assessment and the End Examination marks put together, subject to the condition that he/she has secured at least a **minimum of 30 Marks out of 75 Marks in the End Theory and a minimum of 35 Marks out of 75 Marks in the End Practical Examinations.**

#### **15. Classification of successful candidates:**

Classification of candidates who pass out the final examinations from April 2022 onwards (joined in first year 2019-2020) will be done as specified below.

##### ***First Class with Superlative Distinction***

A Candidate will be declared to have passed in **First Class with Superlative Distinction** if he/she secures not less than 75% of the marks in all the courses and passes all the terms in the first appearance itself and passes all the courses within the stipulated minimum period of study without any break in study.

##### ***First Class with Distinction***

A Candidate will be declared to have passed in **First Class with Distinction** if he/she secures not less than 75% of the aggregate of marks in all the terms put together and passes all the above terms except the I & II Term in the first appearance itself and passes all the courses within the stipulated minimum period of study without any break in study.

##### ***First Class***

A Candidate will be declared to have passed in **First Class** if he/she secures not less than 60% of the aggregate marks in all terms put together and passes all the courses within the stipulated minimum period of study without any break in study.

##### ***Second class***

All other successful candidates will be declared to have passed in **Second Class**.

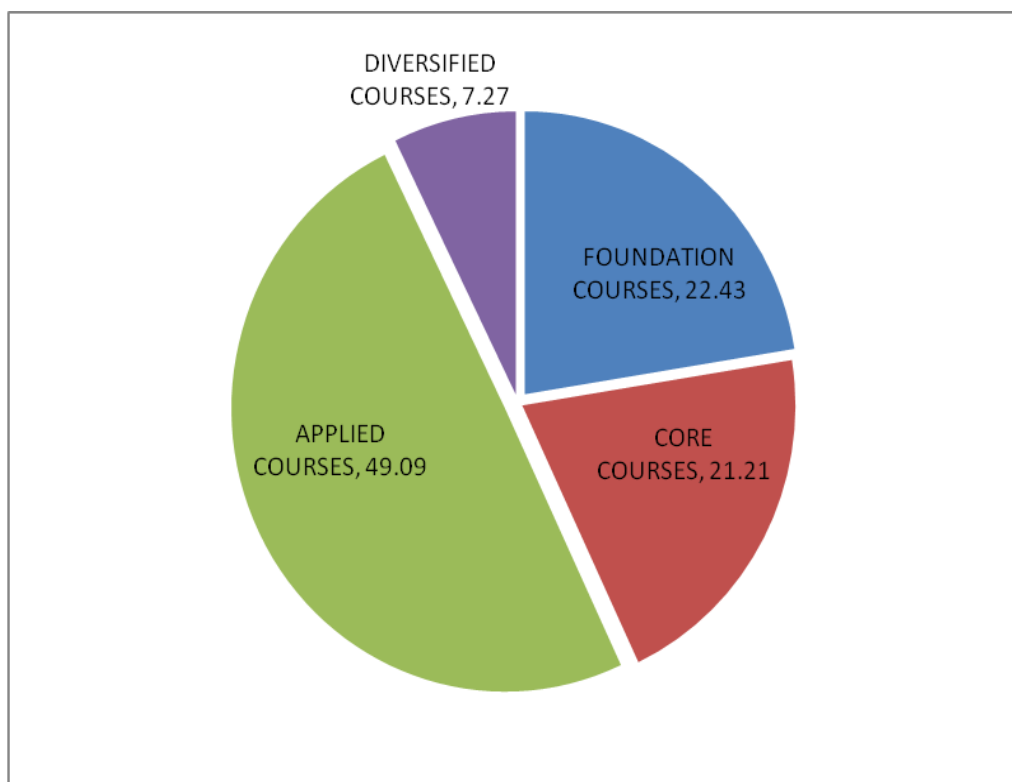
#### **16. Duration of a period in the Class Time Table:**

The duration of each period of instruction is one hour and the total period of instruction hours excluding interval and lunch break in a day should be uniformly maintained as seven hours corresponding to seven periods of instruction (Theory & Practical).

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### TERM WISE CREDITS

Name of the Courses	Credits	Percentage (%)
FOUNDATION COURSES	37	22.43
CORE COURSES	35	21.21
APPLIED COURSES	81	49.09
DIVERSIFIED COURSES	12	7.27
<b>Total Credits</b>	<b>165</b>	<b>100</b>



## TERM WISE CREDITS

Year/Term	Credits	Percentage (%)
I YEAR	50	30.30
III TERM	26	15.76
IV TERM	31	18.79
V TERM	31	18.79
VI TERM	27	16.36
<b>Total Credits</b>	<b>165</b>	<b>100</b>

## LIST OF COURSES

### I) FOUNDATION COURSES

Course Codes	Name of the course	Credits	Prerequisites
N1BE101	COMMUNICATION ENGLISH-I	2	-
N1BE102	ENGINEERING MATHEMATICS	5	-
N1BE103	ENGINEERING PHYSICS-I	3	-
N1BE104	ENGINEERING CHEMISTRY- I	3	-
N1BE105	ENGINEERING PHYSICS -I PRACTICAL	2	-
N1BE106	ENGINEERING CHEMISTRY -I PRACTICAL	2	-
N1BE107	COMMUNICATION SKILL PRACTICAL	3	-
N1BE108	COMPUTER APPLICATION PRACTICAL	3	-
N1BE109	COMMUNICATION ENGLISH-II	2	N1BE101
N1BE110	APPLIED MATHEMATICS	4	N1BE102
N1BE111	ENGINEERING PHYSICS -II	2	N1BE103
N1BE112	ENGINEERING CHEMISTRY-II	2	N1BE104
N1BE113	ENGINEERING PHYSICS -II PRACTICAL	2	N1BE105
N1BE114	ENGINEERING CHEMISTRY -II PRACTICAL	2	N1BE106
<b>TOTAL CREDITS</b>		37	

## II ) CORE COURSES

<b>Course codes</b>	<b>Name of the courses</b>	<b>Credits</b>	<b>prerequisites</b>
N1BE201	ENGINEERING GRAPHICS	5	-
N1BE202	ENGINEERING DRAWING	5	N1BE201
N1BE203	WORKSHOP PRACTICE	3	-
N1ME204	STRENGTH OF MATERIALS	7	-
N1ME205	MACHINE DRAWING	4	N1BE201 & N1BE202
N1ME206	MACHINE DRAWING PRACTICAL	3	N1ME205
N1ME207	ELECTRICAL DRIVES AND CONTROL	6	-
N1ME208	ELECTRICAL DRIVES AND CONTROL PRACTICAL	2	N1ME207
	<b>TOTAL CREDITS</b>	35	-

### III ) APPLIED COURSES

Course codes	Name of the courses	Credits	prerequisites
N1ME301	MANUFACTURING PROCESSES	6	-
N1ME302	FOUNDRY AND WELDING PRACTICAL	2	N1ME301
N1ME303	LATHE AND DRILLING PRACTICAL	2	N1ME301
N1ME304	METROLOGY AND METALLOGRAPHY PRACTICAL	2	-
N1ME305	HEAT POWER ENGINEERING	7	-
N1ME306	SPECIAL MACHINES	6	N1ME301
N1ME307	FLUID MECHANICS AND FLUID POWER	6	-
N1ME308	STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL	2	N1ME204 & N1ME307
N1ME309	SPECIAL MACHINES PRACTICAL	2	N1ME303 & N1ME306
N1ME310	DESIGN OF MACHINE ELEMENTS	7	N1ME204
N1ME311	THERMAL AND AUTOMOBILE ENGINEERING	7	N1ME305
N1ME312	PROCESS PLANNING AND COST ESTIMATION	6	-
N1ME313	PROCESS AUTOMATION PRACTICAL	2	N1ME307
N1ME314	THERMAL AND AUTOMOBILE ENGINEERING PRACTICAL	2	N1ME311 & N1ME305
N1ME315	COMPUTER AIDED DESIGN PRACTICAL	2	N1ME206
N1ME316	INDUSTRIAL ENGINEERING AND MANAGEMENT	7	-
N1ME317	COMPUTER AIDED DESIGN AND MANUFACTURING	6	-
N1ME318	COMPUTER AIDED MANUFACTURING PRACTICAL	3	N1ME317
N1ME319	MACHINE TOOL TESTING, MAINTENANCE AND INSTRUMENTATION PRACTICAL	2	-
N1ME320	PROJECT WORK AND SEMINAR	2	-
<b>TOTAL CREDITS</b>		<b>81</b>	-

#### IV ) DIVERSIFIED COURSES

Course codes	Name of the courses	Credits	prerequisites
	<b>ELECTIVE THEORY-I</b>		-
N1ME401	TOTAL QUALITY MANAGEMENT	5	-
N1ME402	PRESS TOOLS		-
N1ME403	RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION		-
	<b>ELECTIVE THEORY-II</b>		
N1ME404	MECHANICAL INSTRUMENTATION	5	-
N1ME405	ROBOTICS		-
N1ME406	REFRIGERATION AND AIR CONDITIONING		-
N1CO400	NANO AND SOLAR ENGINEERING		-
N1CO402	ELECTRIC VEHICLE		-
	<b>ELECTIVE PRACTICAL-II</b>		
N1ME407	MECHANICAL INSTRUMENTATION PRACTICAL	2	N1ME404
N1ME408	ROBOTICS PRACTICAL.		N1ME405
N1ME409	REFRIGERATION AND AIR CONDITIONING PRACTICAL		N1ME406
N1CO401	NANO AND SOLAR ENGINEERING PRACTICAL		N1CO400
N1CO403	ELECTRIC VEHICLE PRACTICAL		N1CO402
<b>TOTAL CREDITS</b>		<b>12</b>	-

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**CURRICULUM OUTLINE AND SCHEME OF EXAMINATIONS**

**PROGRAMME: All Programmes of Diploma in Engineering and Technology except DMOP**

**N1–SCHEME**

**I TERM**

Course Code	Course Name	Col No	Hours Per week			Credits	Duration of Exam in hours	Examination Marks			Minimum marks For pass
			Theory	Drawing	Tutorial Practical			Internal Assessment marks	External Exam Marks	Total Marks	
N1BE101	Communication English-I	1	4	-	-	2	3	25	75	100	40
N1BE102	Engineering Mathematics	2	7	-	-	5	3	25	75	100	40
N1BE103	Engineering Physics-I	3	5	-	-	3	3	25	75	100	40
N1BE104	Engineering Chemistry– I	4	5	-	-	3	3	25	75	100	40
N1BE201	Engineering Graphics	5	-	6	-	5	3	25	75	100	40
N1BE105	Engineering Physics -I Practical	6	-	-	2	2	3	25	75	100	50
N1BE106	Engineering Chemistry -I Practical	7	-	-	2	2	3	25	75	100	50
N1BE107*	Communication Skill Practical*	8	-	-	3	3	3	25	75	100	50
N1BE108^	Computer Application Practical^										
	Library	-	-	-	1	-	-	-	-	-	-
	<b>Total</b>	-	<b>21</b>	<b>6</b>	<b>8</b>	<b>25</b>	-	<b>200</b>	<b>600</b>	<b>800</b>	-

\* For Circuit Programmes only

^ For Non-Circuit Programmes only

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**CURRICULUM OUTLINE AND SCHEME OF EXAMINATIONS**

**PROGRAMME: All Programmes of Diploma in Engineering and Technology except DMOP**

**N1–SCHEME**

**II TERM**

Course Code	Course Name	Col No	Hours Per week			Credits	Duration of Exam in hours	Examination Marks			Minimum marks For pass
			Theory	Drawing	Tutorial Practical			Internal Assessment marks	External Exam Marks	Total Marks	
N1BE109	Communication English-II	1	4	-	-	2	3	25	75	100	40
N1BE110	Applied Mathematics	2	6	-	-	4	3	25	75	100	40
N1BE111	Engineering Physics-II	3	4	-	-	2	3	25	75	100	40
N1BE112	Engineering Chemistry– II	4	4	-	-	2	3	25	75	100	40
N1BE202	Engineering Drawing	5	-	6	-	5	3	25	75	100	40
N1BE113	Engineering Physics -II Practical	6	-	-	2	2	3	25	75	100	50
N1BE114	Engineering Chemistry –II Practical	7	-	-	2	2	3	25	75	100	50
N1BE203	Workshop Practice	8	-	-	3	3	3	25	75	100	50
N1BE107^	Communication Skill Practical^	9	-	-	3	3	3	25	75	100	50
N1BE108*	Computer Application Practical*										
	Library	-	-	-	1	-	-	-	-	-	-
	<b>Total</b>	-	<b>18</b>	<b>6</b>	<b>11</b>	<b>25</b>	-	<b>225</b>	<b>675</b>	<b>900</b>	-

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**CURRICULUM OUTLINE AND SCHEME OF EXAMINATIONS**

**PROGRAMME: DIPLOMA IN MECHANICAL ENGINEERING  
 N1–SCHEME**

**III TERM**

Course Code	Course Name	Col No	Hours per week			Credits	Duration of Exam in Hrs.	Examination Marks			Minimum Marks for Pass
			Theory	Practical	Others			Internal Assessment marks	External Exam Marks	Total marks	
N1ME204	Strength of Materials	1	6	-	-	7	3	25	75	100	40
N1ME301	Manufacturing Processes	2	6	-	-	6	3	25	75	100	40
N1ME205	Machine Drawing	3	1	-	4	4	3	25	75	100	40
N1ME206	Machine Drawing Practical	4	-	6	-	3	3	25	75	100	50
N1ME302	Foundry and Welding Practical	5	-	4	-	2	3	25	75	100	50
N1ME303	Lathe and Drilling Practical	6	-	4	-	2	3	25	75	100	50
N1ME304	Metrology and Metallography Practical	7	-	4	-	2	3	25	75	100	50
	<b>TOTAL</b>	-	<b>13</b>	<b>18</b>	<b>4</b>	<b>26</b>	-	<b>175</b>	<b>525</b>	<b>700</b>	-

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**CURRICULUM OUTLINE AND SCHEME OF EXAMINATIONS**

**PROGRAMME: DIPLOMA IN MECHANICAL ENGINEERING  
 N1–SCHEME**

**IV TERM**

Course Code	Course Name	Col No	Hours per week			Credits	Duration of Exam in Hrs.	Examination Marks			Minimum Marks for Pass
			Theory	Practical	Others			Internal Assessment marks	External Exam Marks	Total marks	
N1ME305	Heat Power Engineering	1	6	-	-	7	3	25	75	100	40
N1ME306	Special Machines	2	5	-	-	6	3	25	75	100	40
N1ME307	Fluid Mechanics and Fluid Power	3	6	-	-	6	3	25	75	100	40
N1ME207	Electrical Drives and Control	4	6	-	-	6	3	25	75	100	40
N1ME308	Strength of Materials and Fluid Mechanics Practical	5	-	4	-	2	3	25	75	100	50
N1ME309	Special Machines Practical	6	-	4	-	2	3	25	75	100	50
N1ME208	Electrical Drives And Control Practical	7	-	4	-	2	3	25	75	100	50
	<b>TOTAL</b>	-	<b>23</b>	<b>12</b>	-	<b>31</b>	-	<b>175</b>	<b>525</b>	<b>700</b>	-

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**PROGRAMME: DIPLOMA IN MECHANICAL ENGINEERING  
N1–SCHEME**

**V TERM**

Course Code	Course Name	Col No	Hours per week			Credits	Duration of Exam in Hrs.	Examination Marks			Minimum Marks for Pass
			Theory	Practical	Others			Internal Assessment marks	External Exam Marks	Total marks	
N1ME310	Design of Machine Elements	1	6	-	-	7	3	25	75	100	40
N1ME311	Thermal and Automobile Engineering	2	6	-	-	7	3	25	75	100	40
N1ME312	Process Planning and Cost Estimation	3	6	-	-	6	3	25	75	100	40
<b>ELECTIVE THEORY – I</b>											
N1ME401	Total Quality Management	4	5	-	-	5	3	25	75	100	40
N1ME402	Press Tools										
N1ME403	Renewable Energy Sources and Energy Conservation										
N1ME313	Process Automation Practical	5	-	4	-	2	3	25	75	100	50
N1ME314	Thermal and Automobile Engineering Practical	6	-	4	-	2	3	25	75	100	50
N1ME315	Computer aided design practical	7	-	4	-	2	3	25	75	100	50
<b>TOTAL</b>		-	<b>23</b>	<b>12</b>	-	<b>31</b>	-	<b>175</b>	<b>525</b>	<b>700</b>	-

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**PROGRAMME: DIPLOMA IN MECHANICAL ENGINEERING  
N1–SCHEME**

**VI TERM**

Course Code	Course Name	Col No	Hours per week			Credits	Duration of Exam in Hrs.	Examination Marks			Minimum Marks for Pass
			Theory	Practical	Others			Internal Assessment marks	External Exam Marks	Total marks	
N1ME316	Industrial Engineering and Management	1	6	-	-	7	3	25	75	100	40
N1ME317	Computer Aided Design and Manufacturing	2	6	-	-	6	3	25	75	100	40
<b>ELECTIVE THEORY – II</b>											
N1ME404	Mechanical Instrumentation	3	5	-	-	5	3	25	75	100	40
N1ME405	Robotics										
N1ME406	Refrigeration and Air Conditioning										
N1CO400	Nano and Solar Engineering										
N1CO402	Electric Vehicle										
N1ME318	Computer Aided Manufacturing Practical	4	-	6	-	3	3	25	75	100	50
N1ME319	Machine Tool Testing, Maintenance and Instrumentation Practical	5	-	4	-	2	3	25	75	100	50
<b>ELECTIVE PRACTICAL – II</b>											
N1ME407	Mechanical Instrumentation Practical	6	-	4	-	2	3	25	75	100	50
N1ME408	Robotics Practical										
N1ME409	Refrigeration and Air Conditioning Practical										
N1CO401	Nano and Solar Engineering Practical										
N1C0403	Electric vehicle practical										
N1ME320	Project Work and Seminar	7	-	4	-	2	3	25	75	100	50
<b>TOTAL</b>		-	<b>17</b>	<b>18</b>	-	<b>27</b>	-	<b>175</b>	<b>525</b>	<b>700</b>	-

## **INSTITUTE VISION AND MISSION**

### **VISION STATEMENT**

“To be an Institute of excellence in Technical Education and Training of individuals, focusing on the needs of the Nation and Society in tune with Technological Developments”

### **MISSION STATEMENT**

“Our mission is to produce disciplined and Quality Technocrats through academic programme of noted excellence to serve the society”

**Virudhunagar S.Vellaichamy Nadar Polytechnic College (Autonomous), Virudhunagar  
(Affiliated to Directorate of Technical Education, Chennai - Tamil Nadu)**

## **DEPARTMENT OF MECHANICAL ENGINEERING**

### **ABOUT THE PROGRAM**

The department offer 3-years diploma program in mechanical engineering (D.M.E.). Excellent facilities in terms of equipment and staff are available to prepare students as professional mechanical engineers with the focus on innovation, analysis and development of technologies. Excellent infrastructural facilities exist for academic development of the students. The department believes in the philosophy that the students can apply the theoretical knowledge to practice and exploration that eventually leads to experiential learning. The laboratories and workshops in the department have the finest equipment and are maintained impeccably. Dedicated faculty-members keep pace with new trends and developments in the sphere of mechanical engineering. With technological advancement, the significance of machines and tools can hardly be debated.

The mechanical engineering department boasts of strength in the areas of Production, Thermal Science, Automobile Engineering, CAD/CAM, Design, Robotics, Industrial Automation, Industrial Engineering, Total Quality Management etc. Constant and careful attention to the departmental infrastructure has immensely helped in keeping it up-to-date, thus equipping the students with the necessary tools to acquire technical know-how.

### **VISION STATEMENT**

“Be a department of choice to prospective students, parents, faculty, staff, corporate donors, and corporate employers by building strong teaching and learning environment.”

### **MISSION STATEMENT**

“Our Mission is to produce Disciplined and Quality Mechanical Engineering Technocrats through Academic Programme of noted excellence to serve the society.”

## **PROGRAM EDUCATIONAL OBJECTIVES**

- 1. Adaptability to Technological changes: Disciplined and quality Mechanical Engineering Technocrats with academic program of noted excellence will adapt with technological changes.**
- 2. Employability: Technocrats with high skill sets in tune with technological development will get employed in core industries.**
- 3. Entrepreneur: Technocrats with excellence in technical education will become an entrepreneur in the field of Mechanical Engineering to serve the society.**

## **PROGRAM SPECIFIC OBJECTIVE**

- 1. Meet out the current Industrial requirements:** An ability to use the techniques, skills and modern engineering tools necessary for current industrial requirement in the areas of CNC machining, Automation using hydraulics, pneumatics & PLC Controls and Robotics programming for Mechanical Engineering technician practice.
- 2. Introduce the Advanced and Emerging Technology:** An ability to acquire skills and knowledge on Emerging Technology such as Nano & Solar Engineering and Electric Vehicles.

## PROGRAM OUTCOMES

The curriculum and syllabus for Diploma Mechanical Engineering conform to outcome based teaching learning process. In general, **SEVEN PROGRAM OUTCOMES** have been identified and the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these outcomes. Program outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear instructional objectives which are mapped to the program outcomes.

### THE PROGRAM OUTCOMES ARE:

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

### Overall PO, PSO Attainment Matrix

Sl. No.	Term	Course Name	Programme Outcomes (PO's)							Programme Specific Outcome (PSO 's)	
			1	2	3	4	5	6	7	1	2
1.	III	Strength of Materials	3	3	-	-	-	-	1	-	-
2.		Manufacturing Processes	3	3	-	-	-	-	1	-	-
3.		Machine Drawing	3	3	3	-	-	-	-	-	-
4.		Machine Drawing Practical	3	3	-	-	-	-	1	-	-
5.		Foundry and Welding Practical	3	-	-	3	-	-	3	-	-
6.		Lathe and Drilling Practical	3	3	-	3	-	-	3	-	-
7.		Metrology and Metallography Practical	3	3	-	-	-	-	1	-	-
1.	IV	Heat Power Engineering	3	3	-	-	-	-	-	-	-
2.		Special Machines	3	3	-	-	-	-	-	-	-
3.		Fluid Mechanics and Fluid Power	3	3	-	-	-	-	1	-	-
4.		Electrical Drives and Control	3	-	-	3	3	-	1	-	-
5.		Strength of Materials and Fluid Mechanics Practical	3	3	3	1	2	-	2	-	-
6.		Special Machines Practical	3	-	-	3	-	-	3	-	-
7.		Electrical Drives And Control Practical	3	-	-	3	3	-	2	-	-

Sl. No.	Term	Course Name	Programme Outcomes (PO's)							Programme Specific Outcome (PSO 's)	
			1	2	3	4	5	6	7	1	2
1.	V	Design of Machine Elements	3	3	3	-	-	-	3	-	-
2.		Thermal and Automobile Engineering	3	3	-	1	1	-	-	-	-
3.		Process Planning and Cost Estimation	3	-	-	-	2	3	3	-	-
4.		<b>ELECTIVE THEORY – I</b> Total Quality Management	3	3	-	3	-	-	-	-	-
4.		Press Tools	3	3	-	2	-	-	-	-	-
4.		Renewable Energy Sources and Energy Conservation	3	-	-	-	3	-	1	-	-
5.		Process Automation Practical	3	-	3	-	-	-	-	3	-
6.		Thermal and Automobile Engineering Practical	3	3	-	3	-	-	-	-	-
7.		Computer aided design practical	3	3	-	3	-	-	3	-	-

Sl. No.	Term	Course Name	Programme Outcomes (PO's)							Programme Specific Outcome (PSO 's)	
			1	2	3	4	5	6	7	1	2
1.	VI	Industrial Engineering and Management	3	3	-	2	-	1	-	-	-
2.		Computer Aided Design and Manufacturing	3	3	1	1	1	-	1	3	-
3.		ELECTIVE THEORY – II Mechanical Instrumentation	3	3	-	-	-	-	1	-	-
3.		Robotics	3	3	-	-	-	-	1	3	-
3.		Refrigeration and Air Conditioning	3	3	1	-	3	-	3	-	-
3.		Nano and Solar Engineering	3	2	3	3	2	-	1	-	3
3.		Electric Vehicle	2	2	2	1	1	-	1	-	3
4.		Computer Aided Manufacturing Practical	3	3	-	3	-	-	2	3	-
5.		Machine Tool Testing, Maintenance and Instrumentation Practical	3	-	3	3	-	-	-	-	-
6.		ELECTIVE PRACTICAL – II Mechanical Instrumentation Practical	3	3	-	-	-	-	1	-	-
6		Robotics Practical	3	3	-	-	-	-	1	3	-
6		Refrigeration and Air Conditioning Practical	3	3	-	3	-	-	3	-	-
6		Nano and Solar Engineering Practical	3	3	-	3	-	-	-	-	3
6		Electric vehicle practical	1	1	3	3	2	-	1	-	3
7		Project Work and Seminar	3	1	1	2	1	2	2	-	-

**I TERM**

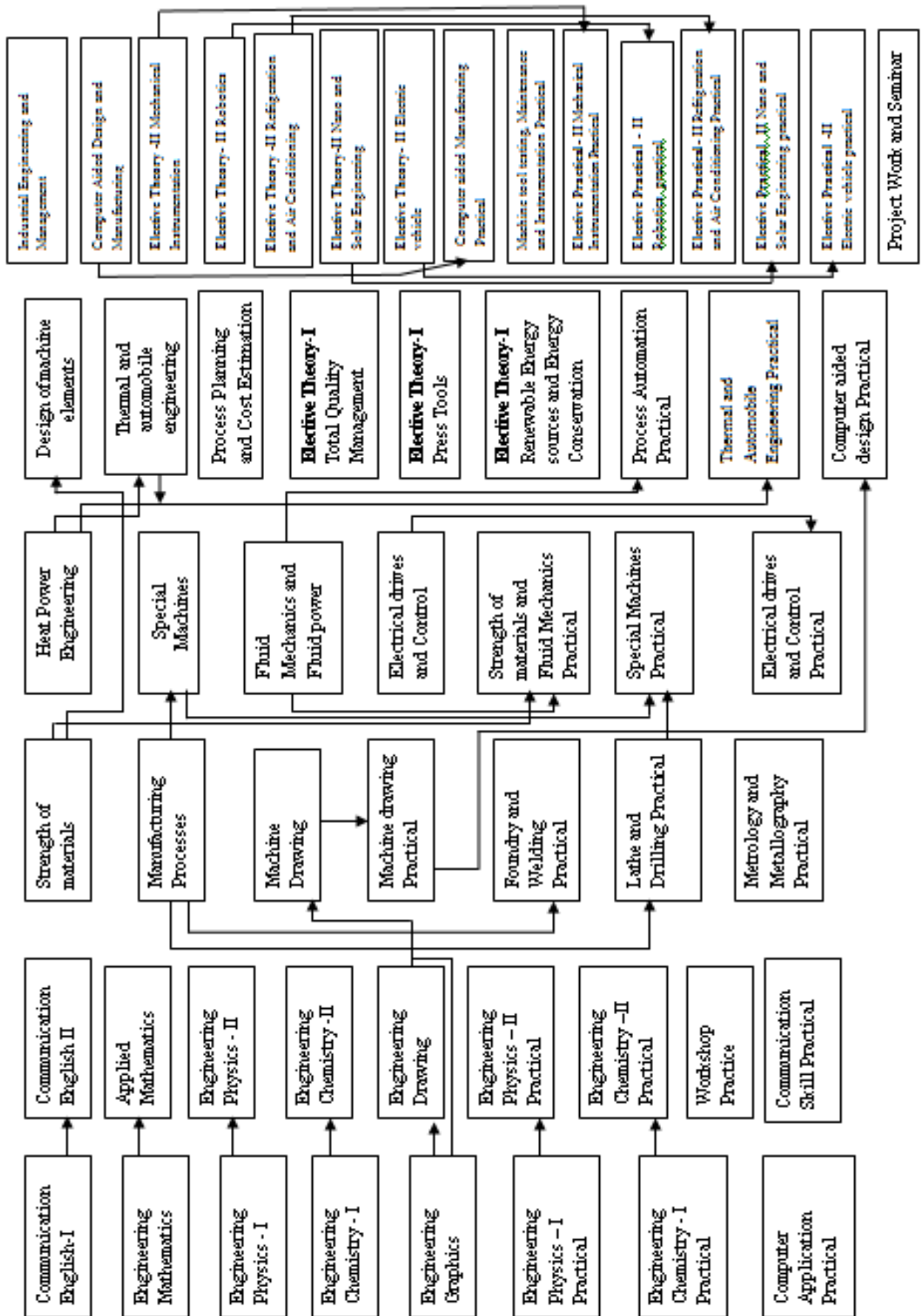
**II TERM**

**III TERM**

**IV TERM**

**V TERM**

**VI TERM**



**VIRUDHUNAGAR S.VELLAICHAMY NADAR POLYTECHNIC COLLEGE  
(AUTONOMOUS)**

(Affiliated to Directorate of Technical Education, Chennai-25)

VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme** : DIPLOMA IN MECHANICAL ENGINEERING  
**Course code** : N1ME204  
**Term** : III  
**Course Name** : STRENGTH OF MATERIALS

**TEACHING AND SCHEME OF EXAMINATION:**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Strength of Materials	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**TOPICS AND ALLOCATION OF HOURS:**

UNIT	Topics	Hours
I	STATICS OF PARTICLE AND FRICTION	18
II	MECHANICAL PROPERTIES, SIMPLE STRESSES AND STRAINS	18
III	GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS	18
IV	SHEAR FORCE AND BENDING MOMENT DIAGRAMS, THEORY OF SIMPLE BENDING	18
V	TORSION AND SPRINGS	18
	<b>Total</b>	<b>90</b>

**Course Outcomes:**

On successful completion of the course, the student will be able to:

C204.1	Acquire elementary knowledge of stresses, strains & material properties and Calculate the deformation of Materials subjected to Loads
C204.2	Understand loss of forces and equilibrium of particles and Estimate the stresses induced in thin shells
C204.3	Determine the moment of Inertia of various sections and understand Thermal Stresses & Fundaments of Friction
C204.4	Able to Draw the Graphical representation of shear force and bending moment of the beam subjected to different loads & Distinguish different types of spring and their applications
C204.5	Understand theory of simple bending and bending equations and solve simple problems involving flexural formulas and Calculate the power transmitted by the solid & hollow shafts

**Course Outcome linkage to Cognitive Level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
C204.1	Acquire elementary knowledge of stresses, strains & material properties and Calculate the deformation of Materials subjected to Loads	R/U/A	PO1, PO2	18
C204.2	Understand loss of forces and equilibrium of particles and Estimate the stresses induced in thin shells	R/U/A	PO1, PO2	18
C204.3	Determine the moment of Inertia of various sections and understand Thermal Stresses & Fundaments of Friction	R/U/A	PO1, PO2	18
C204.4	Able to Draw the Graphical representation of shear force and bending moment of the beam subjected to different loads & Distinguish different types of spring and their applications	R/U/A	PO1, PO2	18
C204.5	Understand theory of simple bending and bending equations and solve simple problems involving flexural formulas and Calculate the power transmitted by the solid & hollow shafts	R/U/A	PO1, PO2. PO7	18
		<b>Total sessions</b>		90

## Course Content and Blue Print of Marks for End Examination:

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	STATICS OF PARTICLE AND FRICTION	18	25	2	18	5	17.86
II	MECHANICAL PROPERTIES, SIMPLE STRESSES AND STRAINS	18	25	2	18	5	17.86
III	GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS	18	25	2	18	5	17.86
IV	SHEAR FORCE AND BENDING MOMENT DIAGRAMS, THEORY OF SIMPLE BENDING	18	25	2	18	5	17.86
V	TORSION AND SPRINGS	18	25	2	18	5	17.86
I to V*			15	6	9	0	10.70
	<b>Total</b>	90	<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100</b>

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

## Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
STRENGTH OF MATERIALS	3	3	-	-	-	-	1

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## NIME204 - STRENGTH OF MATERIALS

### DETAILED SYLLABUS

#### Contents: Theory

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>STATICS OF PARTICLES:</b>                      Introduction – Force - effects of a force - system of forces - resultant of force - Principle of transmissibility - parallelogram law of forces -triangular law - resultant of several forces acting on a particle -polygon law - resolution of a force into rectangular components – resultant of a system of forces acting on a particle using rectangular components - equilibrium of particles.External and internal forces - moment of a force - Varignon’s theorem - moment of a couple - equivalent couples - addition of couples -resolution of a force into a force and a couple - Free body diagram -Necessary and sufficient conditions for the equilibrium of rigid bodies in two dimension - Support reaction - types of support - removal of two dimensional supports - Simple problems only.</p> <p><b>FRICITION:</b>                      Introduction - Definition - Force of friction - Limiting friction - Static friction - Dynamic friction - Angle of friction - co-efficient of friction -Laws of static and dynamic friction</p>	<b>18</b>
<b>II</b>	<p><b>DEFORMATION OF METALS</b>  <b>Mechanical properties of materials:</b> Engineering materials – Ferrous and non-ferrous materials - Definition of mechanical properties - Alloying elements-effect of alloying element - Fatigue, fatigue strength, creep – temperature creep – cyclic loading and repeated loading – endurance limit.</p> <p><b>Simple stresses and strains:</b> Definition – Load, stress and strain – Classification of force systems – tensile, compressive and shear force systems – Behaviour of mild steel in tension up to rupture – Stress – Strain diagram – limit of proportionality – elastic limit – yield stress – breaking stress – Ultimate stress – percentage of elongation and percentage reduction in area – Hooke’s law – Definition – Young’s modulus - working stress, factor of safety, load factor, shear stress and shear strain - modulus of rigidity. Linear strain – Deformation due to tension and compressive force – Simple problems in tension, compression and shear force.</p> <p>Definition – Lateral strain – Poisson’s ratio – volumetric strain – bulk modulus – volumetric strain of rectangular and circular bars – problems connecting linear, lateral and volumetric deformation – Elastic constants and their relationship - Problems on elastic constants - Definition – Composite bar – Problem in composite bars subjected to tension and compression – Temperature stresses and strains – Simple problems – Definition – strain energy – proof resilience – modulus of resilience – The expression for strain energy stored in a bar due to Axial load – Instantaneous stresses due to gradual, sudden, impact and shock loads – Problems computing instantaneous stress and deformation in gradual, sudden, impact and shock loadings.</p>	<b>18</b>

<p><b>III</b></p>	<p><b>GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS</b></p> <p><b>Properties of sections:</b> Definition – center of gravity and centroid -position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium-problems to determine the centroid of angle, channel, T and I sections only - Definition-centroidal axis-Axis of symmetry. Moment of Inertia – Statement of parallel axis theorem and perpendicular axis theorem. Moment of Inertia of lamina of rectangle, circle, triangle, I and channel sections-Definition-Polar moment of Inertia-radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections.</p> <p><b>Thin Shells:</b> Definition – Thin and thick cylindrical shell – Failure of thin cylindrical shell subjected to internal pressure – Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure – simple problems – change in dimensions of a thin cylindrical shell subjected to internal pressure – problems – Derivation of tensile stress induced in a thin spherical shell subjected to internal pressure – simple problems – change in diameter and volume of a thin spherical shell due to internal pressure – problems.</p>	<p><b>18</b></p>
<p><b>IV</b></p>	<p><b>SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING</b></p> <p>Classification of beams – Definition – shear force and Bending moment – sign conventions for shear force and bending moment – types of loadings – Relationship between load, force and bending moment at a section – shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to point load and uniformly distributed load (udl) – Determination of Maximum bending moment in cantilever beam and simply supported beam when they are subjected to point load and uniformly distributed load. Theory of simple bending – Assumptions – Neutral axis – bending stress distribution – moment of resistance – bending equation – <math>M/I=f/y=E/R</math> – Definition – section modulus - rectangular and circular sections – strength of beam – simple problems involving flexural formula for cantilever and simple supported beam.</p>	<p><b>18</b></p>
<p><b>V</b></p>	<p><b>THEORY OF TORSION AND SPRINGS</b></p> <p>Theory of torsion – Assumptions – torsion equation <math>\frac{T}{J} = \frac{f_s}{R} = \frac{C\theta}{l}</math> – strength of solid and hollow shafts – power transmitted – Definition – Polar modulus – Torsional rigidity – strength and stiffness of shafts – comparison of hollow and solid shafts in weight and strength considerations – Advantages of hollow shafts over solid shafts – Problems.</p> <p>Types of springs – Laminated and coiled springs and applications – Types of coiled springs – Difference between open and closely coiled helical springs – closely coiled helical spring subjected to an axial load – problems to determine shear stress, deflection, stiffness and resilience of closed coiled helical springs</p>	<p><b>18</b></p>

**TEXT BOOKS:**

- 1) Strength of Materials, R. S. Khurmi, S.Chand & Co., Ram Nagar, New Delhi..
- 2) Strength of Materials, S. Ramamrutham, 15<sup>th</sup> Edn 2004, DhanpatRai Pub. Co., New Delhi.

**REFERENCE BOOKS:**

- 1) Strength of Materials, R.K. Bansal,, Laxmi Publications Pvt. Ltd., New Delhi, 3<sup>rd</sup> Edition, 2010.
- 2) Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi,2008, ISBN 9780070668959,
- 3) Strength of Materials, B K Sarkar, I Edition, 2003 Tata Mcgraw hill, New Delhi.
- 4) Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 2<sup>nd</sup> Edition, 2007

## MODEL QUESTION PAPER-I

Term : III

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks : 75

Course : Strength of Materials

Course Code: N1ME204

- [ **N.B:** (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]

### PART – A

1. Define Hooke's Law.
2. State Varignon's Theorem.
3. What is Hoop and Longitudinal stress.
4. What is meant by Radius of Gyration?
5. What is Angle of friction?
6. What is the Stiffness of the spring?
7. Define Torsional Rigidity.
8. Write the flexural formula for Bending Theory.

### PART – B

9. A Steel column of 200 mm external diameter and 180 mm internal diameter is 4m long. Determine the shortening of the column when it is subjected to an axial load of 200kN. Young's modulus is  $2.1 \times 10^5$  N/mm<sup>2</sup>.
10. The young's modulus and rigidity modulus of a given material are 120Gpa and 50Gpa respectively. Find the value of the poisson's ratio and bulk modulus.
11. Two concurrent forces of magnitude 10N and 20N are acting at an angle of 60°. Find the resultant force and its direction.
12. A spherical shell of 1m internal diameter and 5mm thick is filled with a fluid under pressure until its volume increases by  $0.2 \times 10^6$  mm<sup>3</sup>. Determine the pressure exerted by the fluid on the shell. Take  $E=2 \times 10^5$  N/mm<sup>2</sup> and  $1/m=0.3$  for the material.
13. Calculate the strain energy that can be stored in a steel bar 40mm diameter and 3m long subjected to a pull of 100kN. Take  $E=200$  kN/mm<sup>2</sup>.
14. A simply supported beam 5m span carries a point load of 20kN at 2m from left support. Draw the SFD and BMD.
15. Distinguish between open and closely coiled helical spring.
16. Calculate the power transmitted by the shaft of 100mm diameter running at 250rpm, if the shear stress in the shaft material is not to exceed 75N/mm<sup>2</sup>.

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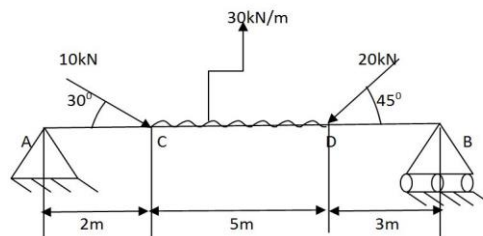
**PART – C**

17. (a) A steel bar 500mm long, 50mm wide and 12mm thick is subjected to an axial pull of 100kN. Determine the changes in length, width, thickness and volume of the bar. Assume  $E=200\text{kN/mm}^2$  and  $1/m=0.3$ .

(Or)

- (b) A reinforced concrete column 500mm×500mm in section is reinforced with 4 steel bars of 25mm dia. One in each corner. The column is carrying a load of 2000KN. Find the stresses in the concrete and steel bars. Take  $E$  for steel =  $2.1 \times 10^5 \text{ N/mm}^2$ ,  $E$  for concrete =  $0.14 \times 10^5 \text{ N/mm}^2$

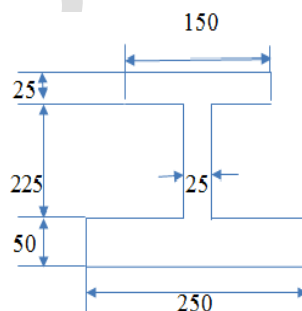
18. (a) Determine support reactions of the beam as shown in figure.



(Or)

- (b) A cylindrical shell 2m long, 500 mm in diameter is made up of 20 mm thick plate, if the cylinder is subjected to an internal pressure of 5 N/mm<sup>2</sup>. Find the value of resulting hoop stress, longitudinal stress, change in diameter, change in length and change in volume. Take poisson's ratio as 0.3 and  $E = 2 \times 10^5 \text{ N/mm}^2$ .

19. (a) Determine the values of  $I_{XX}$  and  $I_{YY}$  for the above I section. The dimensions are in mm.



(Or)

[Turn over .....

(b) A railway is laid so that there is no stress in the rails at 60°C. Calculate (a) the stress in rails at 140°C, if there is no allowance for expansion, (b) the stress in the rails at 140°C, if there is an expansion allowance of 10mm per rail, (c) the expansion allowance if the stress in the rail is to be zero when the temperature is 140°C. The rails are 25 meters long. Take  $\alpha = 12 \times 10^{-6}$  per °C and  $E = 2 \times 10^5$  N/mm<sup>2</sup>.

20. (a) A simply support beam of length 6m carries a udl of 20kN/m throughout its length and a point load of 30kN at 2m from the right support. Draw the SF and BM diagrams. Also find the position and magnitude of maximum Bending moment.

(Or)

(b) Design a closely helical spring of stiffness 20N/mm deflection. The maximum shear stress in the spring metal is not to exceed 80N/mm<sup>2</sup> under a load of 600N. The diameter of the coil is to be 10 times the diameter of the wire. Take the modulus of rigidity as 85kN/mm<sup>2</sup>.

21. (a) A Cantilever of length 3m carries a UDI of 5kN/m over the entire length together with a point load 20kN at the free end. The moment of inertia of the beam section is  $160 \times 10^7$  mm<sup>4</sup> and its depth is 300mm. Determine the maximum bending stress.

(Or)

(b) A hollow shaft having inner diameter 0.6 times the outer diameter is to be replace a solid shaft of the same material to transmit 550kW at 220rpm. The permissible shear stress is 80N/mm<sup>2</sup>. Calculate the diameters of the hollow shaft and solid shafts. Also calculate the percentage of saving in material.

## MODEL QUESTION PAPER-II

Term	: III	Time	: 3 hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Strength of Materials	Course Code	: N1ME 204

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.**

**Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.**

**(2) Answer division (a) or division (b) of each question in PART – C.**

**(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B and 10 Marks in PART – C. ]**

### PART – A

- 1) Define creep.
- 2) What is free body diagram?
- 3) Define radius of gyration.
- 4) What is meant by neutral axis?
- 5) Write torsion equation.
- 6) Define bending moment of the beam.
- 7) Define composite bar.
- 8) Define polar modulus.

### PART – B

- 9) Draw the stress strain diagram for mild steel in tension and explain the salient features.
- 10) State the classification of force system
- 11) Find the centroid of a channel section 100mm×50mm×15mm.
- 12) Distinguish between open and closely coiled helical spring.
- 13) Calculate the section modulus of hollow circular section of outer diameter 100mm and 50mm inner diameter
- 14) Define hogging and sagging BM of the beam
- 15) Explain the following term
  - I. Static friction
  - II. Dynamic friction.
- 16) A boiler shell is 1.8m in diameter and 15mm in thickness. The permissible tensile stress in the boiler plate is not to exceed  $70 \text{ N/mm}^2$ . Determine the allowable working pressure of the boiler.

**[Turn over .....**

**PART - C**

- 17) a. A steel bar 500mm long, 50mm wide and 12mm thick is subjected to an axial pull of 100KN. Determine change in dimensions of the bar. Assume  $E=200 \text{ KN/mm}^2$  and  $1/m$  or  $\mu = 0.3$ .

(Or)

- b. A reinforced concrete column 300mm×450mm has 6 steel rod of 25mm diameter. Calculate the safe load for the column. If the allowable stress in the concrete is  $5 \text{ N/mm}^2$  and  $E_s = 15 E_c$  also find the stress in the steel bar.

- 18) a. The following forces is act at a point

- I. 200N inclined at  $30^\circ$  towards north of east
- II. 250N towards north
- III. 300N towards north west
- IV. 350N inclined at  $40^\circ$  towards south of west

(Or)

- b. A thin cylindrical shell of 1m internal diameter 5mm thick and 2.5m long is filled with a fluid under pressure until its volume increases by  $40 \times 10^6 \text{ mm}^3$ . Determine the pressure exerted by the fluid on the shell. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $1/m$  or  $\mu = 0.25$ .

- 19) a. Find the moment of inertia about the centroidal axes of an I section having g equal flanges 120mm×20mm size and web 120mm×20mm thick. And also find the  $K_{XX}$  and  $K_{YY}$ .

(Or)

- b. It is found that the rod 40mm diameter stretches 1mm under a gradually applied load of 100KN. If a weight of 200KN is dropped on to a collar at the lower end of the rod through a height of 60mm. Calculate maximum instantaneous stress and elongation produced. Take  $E= 200 \text{ KN/mm}^2$ .

- 20) a. A Beam is freely supported over span of 8m. It carries a point load of 3KN at 2m from left hand support and a UDL of 2KN/m from the centre up to the right hand support. Draw SFD and BMD.

(Or)

- b. Design a closed coil helical spring of stiffness 20N/mm deflection. The maximum shear stress in the spring metal is not to exceed  $80 \text{ N/mm}^2$  under a load of 600N. The diameter of the coil is 10 times the diameter of wire. Modulus of rigidity is  $85 \text{ KN/mm}^2$ .

- 21) a. Prove  $\frac{M}{I} = \frac{E}{R} = \frac{\sigma}{y}$

(Or)

- b. A hollow shaft having inner diameter 0.7 times the outer diameter is to replace a solid shaft of the same material to transmit 500KW at 200rpm. The permissible shear stress is  $80 \text{ N/mm}^2$ . Calculate the diameter of solid and hollow shafts. Calculate also the percentage saving material.

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME301**

**Term : III**

**Course Name : MANUFACTURING PROCESSES**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Manufacturing Processes	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**TOPICS AND ALLOCATION OF HOURS:**

UNIT	Topics	Hours
I	FOUNDRY TECHNOLOGY	18
II	WELDING TECHNOLOGY	18
III	FORMING TECHNOLOGY	18
IV	THEORY OF METAL CUTTING & LATHE	18
V	DRILLING & METROLOGY	18
	<b>TOTAL</b>	<b>90</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C301.1</b>	Acquire knowledge about types of pattern, molding, casing, Metallurgy & Melting Furnaces
<b>C301.2</b>	Describe the various arc welding, gas welding processes and appreciate the types of joints, testing of Weld and Safety practices.
<b>C301.3</b>	Understand Forging, Press and press working operations & powder metallurgy process
<b>C301.4</b>	Understand Theory of Metal Cutting & lathe and its working parts and describe the functioning of semi-automatic lathes
<b>C.301.5</b>	Comprehend drilling machine and operations and familiarize in measuring instruments and comparator.

**Course Outcome linkage to Cognitive Level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
<b>C301.1</b>	Acquire knowledge about types of pattern, molding, casing, Metallurgy & Melting Furnaces	<b>R/U/A</b>	PO1, PO2	18
<b>C301.2</b>	Describe the various arc welding, gas welding processes and appreciate the types of joints, testing of Weld and Safety practices.	<b>R/U/A</b>	PO1, PO2	18
<b>C301.3</b>	Understand Forging, Press and press working operations & powder metallurgy process	<b>R/U/A</b>	PO1, PO2	18
<b>C301.4</b>	Understand Theory of Metal Cutting & lathe and its working parts and describe the functioning of semi-automatic lathes	<b>R/U/A</b>	PO1, PO2	18
<b>C301.5</b>	Comprehend drilling machine and operations and familiarize in measuring instruments and comparator.	<b>R/U/A</b>	PO1, PO2. PO7	18
			<b>Total sessions</b>	90

### Course Content and Blue Print of Marks for End Examination:

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	FOUNDRY TECHNOLOGY	18	25	2	18	5	17.86
II	WELDING TECHNOLOGY	18	25	2	18	5	17.86
III	FORMING TECHNOLOGY	18	25	2	18	5	17.86
IV	THEORY OF METAL CUTTING & LATHE	18	25	2	18	5	17.86
V	DRILLING & METROLOGY	18	25	2	18	5	17.86
I to V*			15	6	9	0	10.70
	<b>Total</b>	90	<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100</b>

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

### Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
MANUFACTURING PROCESSES	3	3	-	-	-	-	1

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

# N1ME301 - MANUFACTURING PROCESSES

## DETAILED SYLLABUS

### Contents: Theory

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>Foundry Technology</b>  <b>Patterns:</b> Definition – types of pattern – solid piece – split piece - loose piece – match plate - sweep - skeleton – segmental – shell – pattern materials – pattern allowances.  <b>Moulding:</b> Moulding sand – constituents – types – properties of moulding sand – moulding sand preparation – moulding tools -moulding boxes – types of moulds – green sand mould – dry sand mould – loam mould – methods of moulding – moulding machines – jolting – squeezing – sand slinger construction and working principle.  <b>Cores:</b> Essential qualities of core – materials – core sand preparation – core binders – core boxes - CO<sub>2</sub> process core making – types of core.  <b>Metallurgy</b> :- Introduction - Iron-carbon diagram.  <b>Melting furnaces:</b> Blast furnace – Cupola furnace – crucible furnace – types – pit furnace – coke fired – oil fired – electric furnace – types – direct arc – indirect arc – induction furnace – working principles.  <b>Casting:</b> Shell mould casting – investment casting – pressure die casting – hot chamber die casting – cold chamber die casting – gravity die casting – centrifugal casting – continuous casting -defects in casting – causes and remedies.</p>	<b>18</b>
<b>II</b>	<p><b>Welding Technology</b>  <b>Arc Welding:</b> Definition – arc welding equipment – electrode types – filler and flux materials - arc welding methods – metal arc -Metal Inert gas (MIG) - Tungsten inert gas (TIG) - Submerged arc - Electro slag welding – resistance welding – spot welding – butt welding – seam welding – Plasma arc welding – Thermit welding – Electron beam welding – Laser beam welding – friction welding – ultrasonic welding – Induction welding - working principle – applications – advantages and disadvantages.  <b>Gas welding:</b> Oxy-acetylene welding – advantages - limitations -gas welding equipment - Three types of flames – welding techniques – filler rods. – Flame cutting – soldering – brazing – difference between soldering and brazing.  Types of welded joints – merits and demerits of welded joints – inspection and testing of welded joints – destructive and non-destructive types of tests – magnetic particle test – radiographic and ultrasonic test - defects in welding – causes and remedies.</p>	<b>18</b>
<b>III</b>	<p><b>Forming Technology</b>  <b>Forging:</b> Hot working, cold working – advantages of hot working and cold working– hot working operations – rolling, forging, smith forging, drop forging, upset forging, press forging – roll forging.  <b>Press Working:</b> Types of presses - mechanical and hydraulic presses - press tools and accessories - press working operations -bending operations - angle bending - channel bending – curling – drawing - shearing operations - blanking, piercing, trimming – notching – lancing.  <b>Powder Metallurgy:</b> Methods of manufacturing metal powders – atomization, reduction and electrolysis deposition – compacting – sintering – sizing – infiltration – mechanical properties of parts made by powder metallurgy – design rules for the powder metallurgy process.</p>	<b>18</b>
<b>IV</b>	<p><b>Theory of metal cutting:</b> Introduction – orthogonal cutting –oblique cutting - single point cutting tool – nomenclature – types</p>	<b>18</b>

	<p>of chips – chip breakers – cutting tool materials – properties – tool wears – factors affecting tool life – cutting fluids – functions – properties of cutting fluid.</p> <p><b>Centre Lathe:</b> Introduction - specifications – simple sketch – principal parts – head stock – back geared type – all geared type – feed mechanism - tumbler gear mechanism – quick change gear box – apron mechanism – work holding device – three jaw chuck – four jaw chuck – centres - faceplate – mandrel – steady rest – follower rest – machining operations done on lathe - straight turning – step turning - taper turning methods: form tool – tailstock set over method – compound rest method – taper turning attachment – knurling - Thread cutting – Facing – Boring – chamfering –grooving – parting-off – eccentric turning - cutting speed – feed - depth of cut - metal removal rate.</p> <p><b>Semi-Automatic Lathes:</b> Types of semi-automatic lathes – capstan and turret lathes – Geneva indexing mechanism – bar feeding mechanism - difference between turret and capstan – work holding devices – tool holders.</p>	
V	<p><b>Drilling and Metrology</b></p> <p><b>Drilling Machines:</b> Drills - flat drills - twist drills – nomenclature of twist drill - types of drilling machines - bench type - floor type -radial type - gang drill – multi spindle type -principle of operation in drilling - methods of holding drill bit - drill chucks - socket and sleeve –drilling operation – reaming - counter sinking - counter boring - spot facing – tapping - deep hole drilling.</p> <p><b>Metrology:</b> Definition – need of inspection – precision – accuracy – sensitivity - magnification – repeatability – calibration – comparator – Advantages – requirements – mechanical comparator – optical comparator – electrical comparator – pneumatic comparator –Principles – advantages and disadvantages.</p> <p><b>Measuring instruments:</b> Construction and principles only - Steel rule – Callipers: outside calliper – inside calliper – jenny calliper – Combination set – Feeler gauge – Pitch screw gauge – Vernier calliper – Digital calliper – Vernier height gauge – Micrometer – Inside micrometer – Thread micrometer – Slip gauges – requirement – Indian standard – care and use - Sine bar – types – uses –limitations – Working principle of clinometers, autocollimator, angle dekkor.</p>	18

## **TEXT BOOKS:**

- 1) Elements of workshop Technology Volume I & II – Hajra Chowdry & Bhattacharaya - II<sup>th</sup> Edition - Media Promoters & Publishers Pvt. Ltd., Seewai Building 'B', 20-G, Noshir Bharucha Marg, Mumbai 400 007 – 2007.
- 2) Introduction of basic manufacturing processes and workshop technology – Rajendersingh – New age International (P) Ltd. Publishers, 4835/24, Ansari Road, Daryaganj, New Delhi - 110002

## **REFERENCE BOOKS:**

- 1) Manufacturing process – Begeman - 5<sup>th</sup> Edition -McGraw Hill, New Delhi 1981.
- 2) Workshop Technology- WAJ Chapman - Volume I, II, & III – Vima Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
- 3) Workshop Technology – Raghuwanshi - Khanna Publishers. Jain & Gupta,
- 4) Production Technology, Edn. XII, Khanna Publishers, 2-B, North Market, NAI Sarak, New Delhi 110 006 - 2006
- 5) Production Technology - P. C. SHARMA - Edn. X - S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 - 2006
- 6) Production Technology – HMT - Edn. 18 - published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel nagar, New Delhi 110 008. – 2001.

## MODEL QUESTION PAPER-I

Term : III Time : 3 Hours  
Programme : Diploma in Mechanical Engineering Max. Marks : 75  
Course : Manufacturing Processes Course Code: N1ME301

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.**

**(2) Answer division (a) or division (b) of each question in PART – C.**

**(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What is pattern?
2. Different type of welding joint.
3. What is hot working?
4. State the type of chips.
5. What is powder metallurgy?
6. State the advantage of cold working.
7. Write the type of pattern materials?
8. Write short note about mechanical comparator.

### PART – B

9. What are the advantages of centrifugal casting?
10. What are the various methods of testing of welding joints?
11. What various heat treatment processes?
12. Describe the different types of tool wear.
13. Explain any five operation of drilling.
14. Types of Gas Flames?
15. How are the measuring instruments classified?
16. Explain CO<sub>2</sub> process of core making.

**[Turn over .....**

**PART – C**

17. (a) Explain with neat sketch the various types of patterns.

*(Or)*

(b) Explain with neat sketch Hot chamber pressure die casting & Cold chamber Pressures die casting.

18. (a) Explain with neat sketch the Plasma Arc welding process.

*(Or)*

(b) Explain with neat sketch TIG welding & MIG welding.

19. (a) Explain Hot working operation with Types?

*(Or)*

(b) Briefly explain about methods of manufacturing powders.

20. (a) Write the Centre lathe & any one mechanism explain.

*(Or)*

(b) Different between Turret and Capstan.

21. (a) Explain with neat sketch Radial type drilling machine.

*(Or)*

(b) Explain clinometers and angle dekkor with sketches.

## MODEL QUESTION PAPER-II

Term : III Time : 3 Hours  
Programme : Diploma in Mechanical Engineering Max. Marks : 75  
Course : Manufacturing Processes Course Code: N1ME301

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.**

**(2) Answer division (a) or division (b) of each question in PART – C.**

**(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. Define split piece pattern.
2. Name any two crucible furnace.
3. Name the three types of gas flames.
4. State any two limitations of gas welding.
5. Difference between Drop forging and press forging.
6. What is lancing.
7. Name any two types of lathe.
8. Define metrology.

### PART – B

9. Name different materials used for making pattern.
10. What is the purpose of core?
11. Why laser beam welding is so called?
12. What are the advantages of hot working?
13. Write notes of forging.
14. List out various factors that influence tool life.
15. What are the different types of drilling machine?
16. Sketch and explain inside caliper.

[Turn over .....

**PART – C**

17. (a) Explain any four properties of the moulding sand.

(Or)

(b) Sketch and explain the continuous casting process state its applications.

18. (a) Explain with neat sketch of Laser beam welding.

(Or)

(b) Explain with neat sketch TIG welding & MIG welding.

19. (a) Explain Hot and cold rolling processes with sketches.

(Or)

(b) Sketch and explain the atomization and electrolysis deposition processes.

20. (a) Write the Centre lathe & any one mechanism explain.

(Or)

(b) Sketch and explain bar feeding mechanism.

21. (a) Sketch and explain the nomenclature of twist drill bit.

(Or)

(b) Sketch and explain any two comparators.

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME205**

**Term : III**

**Course Name : MACHINE DRAWING**

**TEACHING AND SCHEME OF EXAMINATION:**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Machine Drawing	5	75	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**TOPICS AND ALLOCATION OF HOURS:**

UNIT	Topics	Hours
I	SECTIONAL VIEWS	8
II	LIMITS, FITS AND TOLERANCES	8
III	SURFACE TEXTURE	7
IV	KEYS, SCREW THREADS AND THREADED FASTENERS	7
V	ASSEMBLE DRAWING	45
	<b>TOTAL</b>	<b>75</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C205.1</b>	Explain need for sectional view and types of sections used in manual drawing practice.	
<b>C205.2</b>	Explain types of fits used, limits and tolerances of dimensions.	
<b>C205.3</b>	Explain the surface texture and machining symbols.	
<b>C205.4</b>	Explain the types of fasteners and study of temporary fasteners like keys, screw threads and threaded fasteners used in assembly process.	
<b>C205.5</b>	Draw assembly drawing of the components to give a thorough knowledge of manual drawings.	

## Course Outcome linkage to Cognitive Level:

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO	Teaching Hrs
<b>C205.1</b>	Explain need for sectional view and types of sections used in manual drawing practice.	U	PO1, PO2, PO3	8
<b>C205.2</b>	Explain types of fits used, limits and tolerances of dimensions.	U	PO1, PO2, PO3	8
<b>C205.3</b>	Explain the surface texture and machining symbols.	U	PO1, PO2, PO3	7
<b>C205.4</b>	Explain the types of fasteners and study of temporary fasteners like keys, screw threads And threaded fasteners used in assembly process.	U	PO1, PO2, PO3	7
<b>C205.5</b>	Draw assembly drawing of the components to give a thorough knowledge of manual drawings.	A	PO1, PO2, PO3	45
			<b>Total sessions</b>	75

## Course Content and Blue Print of Marks for End Examination:

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	SECTIONAL VIEWS	8	10	-	10	-	7.14 %
II	LIMITS, FITS AND TOLERANCES	8	10	-	10	-	7.14 %
III	SURFACE TEXTURE	7	10	-	10	-	7.14 %
IV	KEYS , SCREW THREADS AND THREADED FASTENERS	7	10	-	10	-	7.14 %
V	MANUAL DRAWING PRACTICE	45	100	-	-	100	71.44 %
I to V*		-	-	-	-	-	-
<b>Total</b>		<b>75</b>	<b>140</b>	-	<b>40</b>	<b>100</b>	<b>100 %</b>

## Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
MACHINE DRAWING	3	3	3	-	-	-	-

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

# NIME205 – MACHINE DRAWING

## DETAILED SYLLABUS

### Contents: Theory

Unit	Name of the Topics	Hours
<b>I</b>	<b>SECTIONAL VIEWS</b> Review of sectioning – Conventions showing the section – symbolic representation of cutting plane- types of section – full section, half section, offset section, revolved section, broken section, removed section – section lining.	<b>8</b>
<b>II</b>	<b>LIMITS, FITS AND TOLERANCES</b> Tolerances – Allowances – Unilateral and Bilateral tolerances. Limits – Methods of tolerances – Indication of tolerances on linear dimension of drawings – Geometrical tolerances – application – Fits – Classifications of fits – Selection of fits – examples	<b>8</b>
<b>III</b>	<b>SURFACE TEXTURE</b> Surface texture – importance – controlled and uncontrolled surfaces – Roughness – Waviness – lay – Machining symbols	<b>7</b>
<b>IV</b>	<b>KEYS, SCREW THREADS AND THREADED FASTENERS</b> Types of fasteners – temporary fasteners – keys – classification of keys – Heavy duty keys – light duty keys. Screw thread – Nomenclature – different types of thread profiles – threads in sections – threaded fasteners – bolts – nuts – through bolt – tap bolt, stud bolt – set screw – cap screws – machine screws – foundation bolts	<b>7</b>
<b>V</b>	<b>MANUAL DRAWING PRACTICE</b> Detailed drawings of following machine parts are given to students to assemble and draw the Elevations / Sectional elevations / Plan / and Side views with dimensioning and bill of materials 1.Sleeve and Cotter joint 2.Knuckle joint 3.Screw Jack 4.Foot step bearing 5.Plummer Block 6.Universal Coupling 7.Simple Eccentric 8.Machine Vice 9.Protected type flanged coupling 10. Swivel bearing.	<b>45</b>

**TEXT BOOKS:**

- 1) A Text book of Engineering Drawing, R.B. Gupta, Satya Prakasan, Technical India Publications, New Delhi.
- 2) A Text book of Machine drawing – K.C.John
- 3) A Text book of Machine drawing – R.K.Dhawan

**REFERENCE BOOKS:**

- 1) Machine Drawing, P.S. Gill, Katsan Publishing House, Ludiana
- 2) Mechanical Draughtsmanship, G.L. Tamta, Dhanpat Rai & Sons, Delhi
- 3) Geometrical and Machine Drawing, N.D. Bhatt, Cheroter book stalls, Anand, West Railway
- 4) Engineering Drawing, D.N. Ghose, Dhanpat Rai & Sons, Delhi

**Question Pattern for Machine Drawing in mechanical engineering:****Course Code: N1ME205****Course Name: Machine Drawing****All the questions will be answered in drawing sheet only****a) Question Paper Pattern for Periodical (Test – I & Test – II)****With No choice – Theory questions: one question from one unit & two questions from other unit will be asked (PART – A). Assemble and Draw any two views and bill of materials (PART – B)**

PART A:	3 Question × 5 marks	-	15 Marks
PART B:	1 Question × 35 marks	-	35 Marks
			-----
			50 marks
			-----

## MODEL QUESTION PAPER-I

Term : III

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks : 75

Course : Machine Drawing

Course Code: N1ME205

- [ N.B: (1) Answer any SEVEN Questions in each PART – A and answer division (a) or (b) in PART - B  
(2) Each question carries 5marks in part A, 40 marks in part B  
(3) All questions are to be answered in the drawing sheet only**

### PART – A

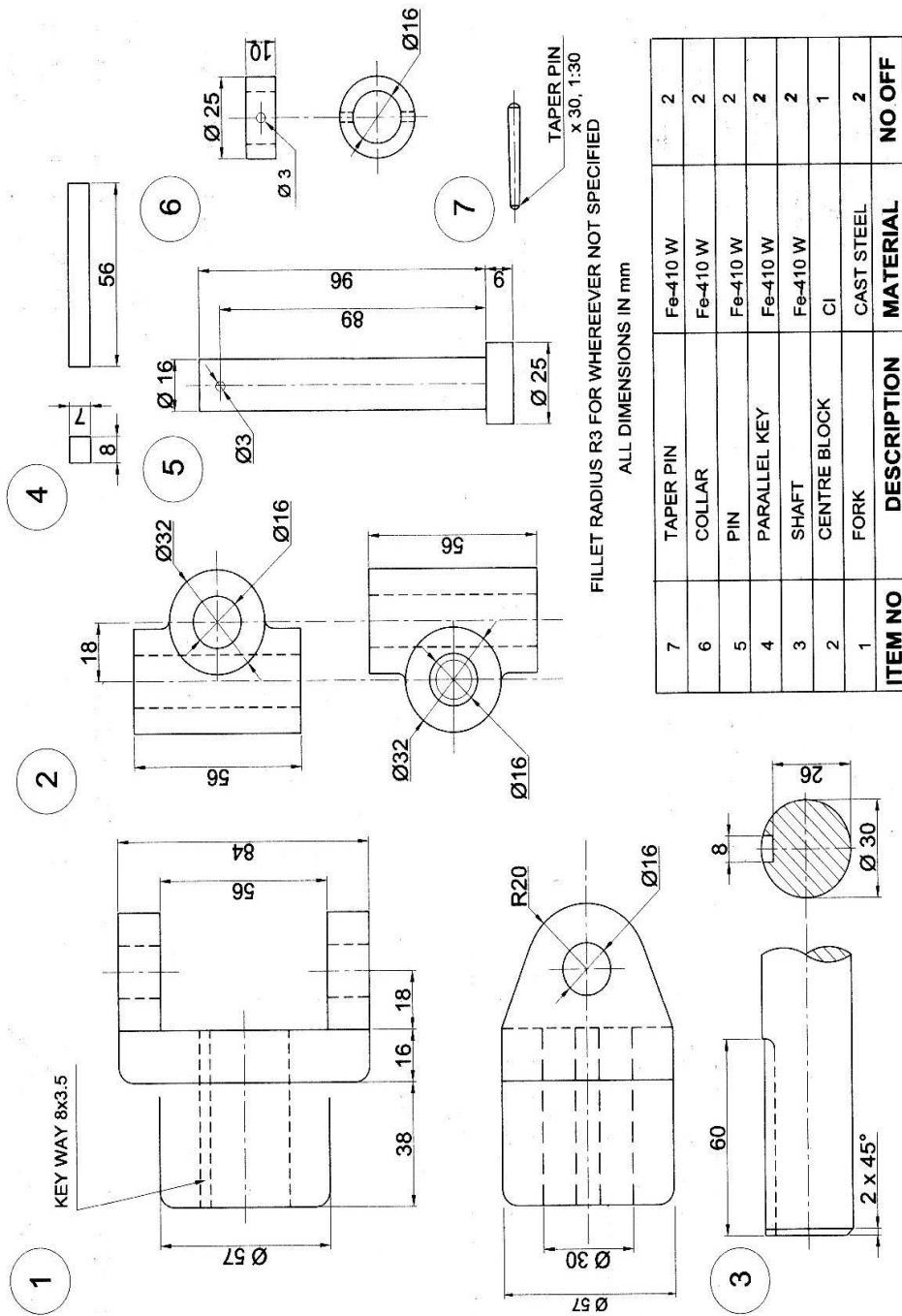
1. Sketch the broken end of solid shaft.
2. Illustrate revolved section
3. How will you indicate tolerance on linear dimension of drawing?
4. Draw the symbol for parallelism.
5. What are controlled and uncontrolled surfaces?
6. Sketch the basic machining symbol for indicating surface roughness
7. How are keys classified?
8. Mention the different types of thread profiles.

### PART – B

9. a) Assemble and draw the following two views of the Universal coupling given in sketch A.
- |                        |          |
|------------------------|----------|
| i. Sectional elevation | 20 marks |
| ii. Plan               | 15 marks |
| iii. Bill of material  | 5 marks  |
- (Or)
- b) Assemble and draw the following two views of the sleeve and cotter given in sketch B.
- |                        |          |
|------------------------|----------|
| i. Sectional elevation | 20 marks |
| ii. Left side view     | 15 marks |
| iii. Bill of material  | 5 marks  |

**[Turn over .....**

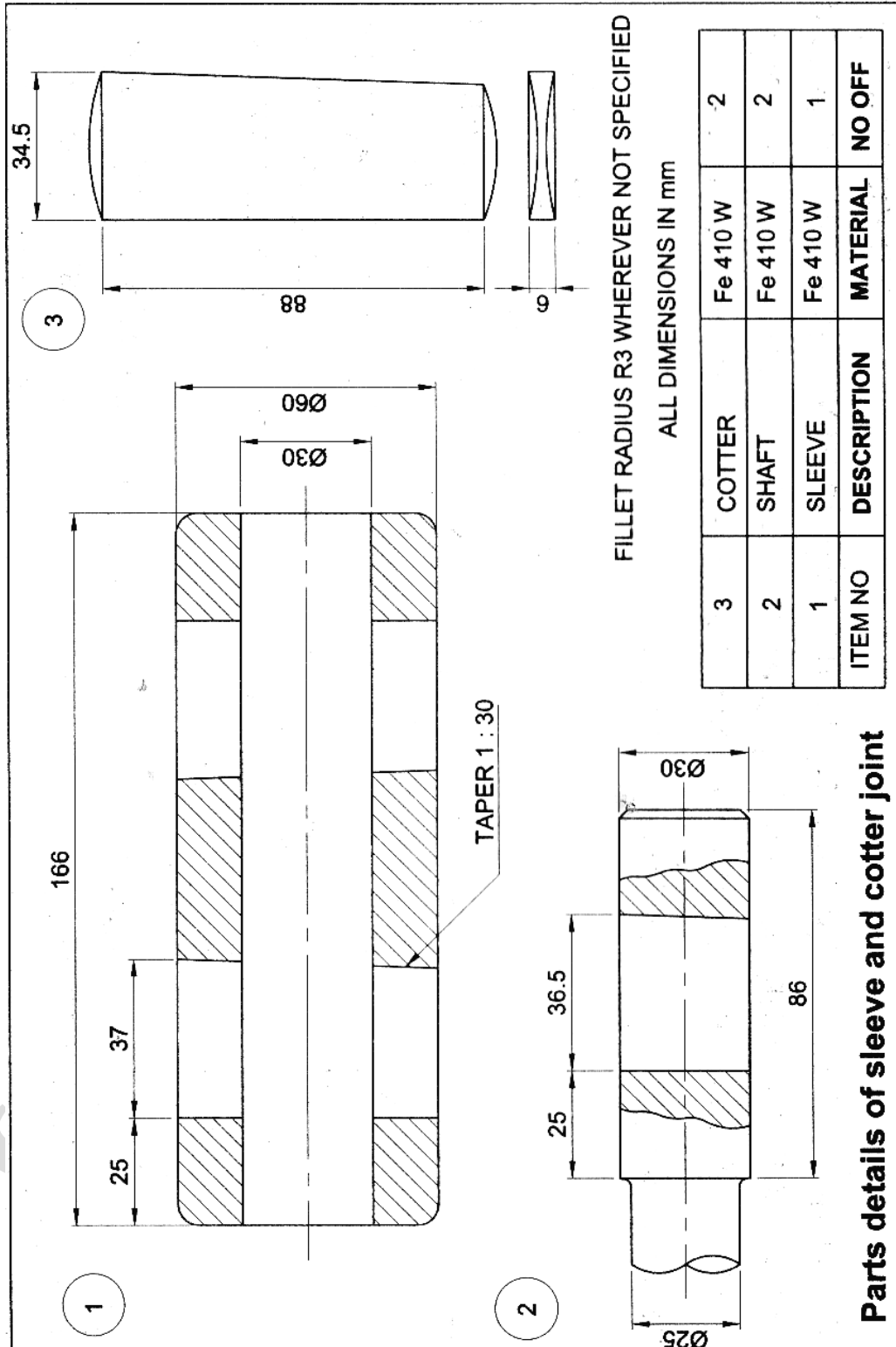
Sketch A.



ITEM NO	DESCRIPTION	MATERIAL	NO OFF
7	TAPER PIN	Fe-410 W	2
6	COLLAR	Fe-410 W	2
5	PIN	Fe-410 W	2
4	PARALLEL KEY	Fe-410 W	2
3	SHAFT	Fe-410 W	2
2	CENTRE BLOCK	CI	1
1	FORK	CAST STEEL	2

Parts details of universal coupling

[Turn over .....



**Parts details of sleeve and cotter joint**

## MODEL QUESTION PAPER-II

Term : III

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks : 75

Course : Machine Drawing

Course Code: N1ME205

- [N.B:] (1) Answer any SEVEN Questions in each PART – A and answer division (a) or (b) in PART - B**  
**(2) Each question carries 5marks in part A, 40 marks in part B**  
**(3) All questions are to be answered in the drawing sheet only**

### PART – A

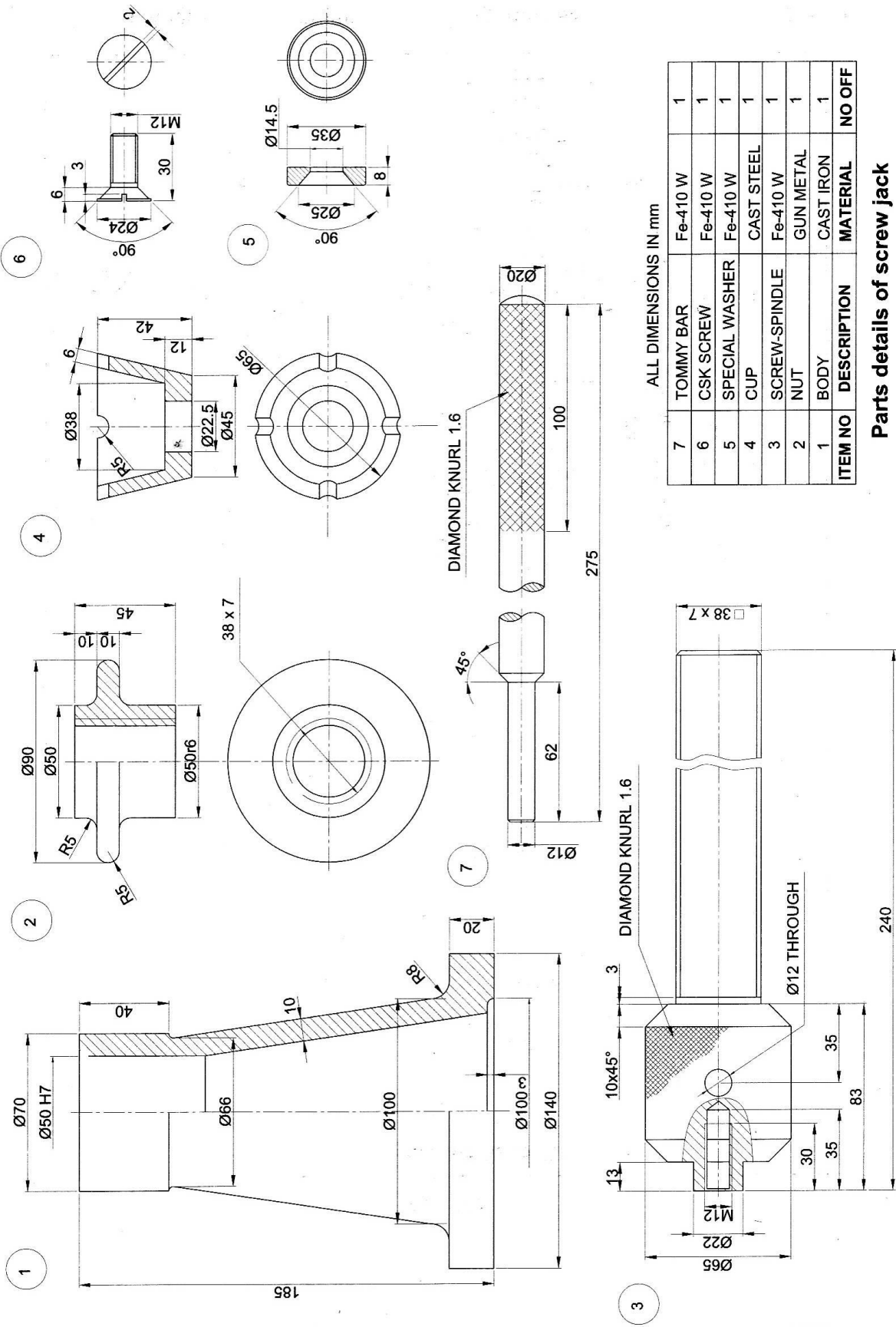
1. Explain the revolved section with sketch.
2. Explain the half section with sketch.
3. How will you indicate tolerance on linear dimension of drawing?
4. Describe about the clearance fit.
5. What is surface texture?
6. Describe about lay.
7. How are keys classified?
8. Describe about foundation belt.

### PART – B

9. a) Assemble and draw the following two views of the screw jack given in sketch A.
- |                        |          |
|------------------------|----------|
| i. Sectional elevation | 20 marks |
| ii. Right side view    | 15 marks |
| iii. Bill of material  | 5 marks  |
- (Or)
- b) Assemble and draw the following two views of the Machine vice given in sketch B.
- |                        |          |
|------------------------|----------|
| i. Sectional elevation | 20 marks |
| ii. Plan               | 15 marks |
| iii. Bill of material  | 5 marks  |

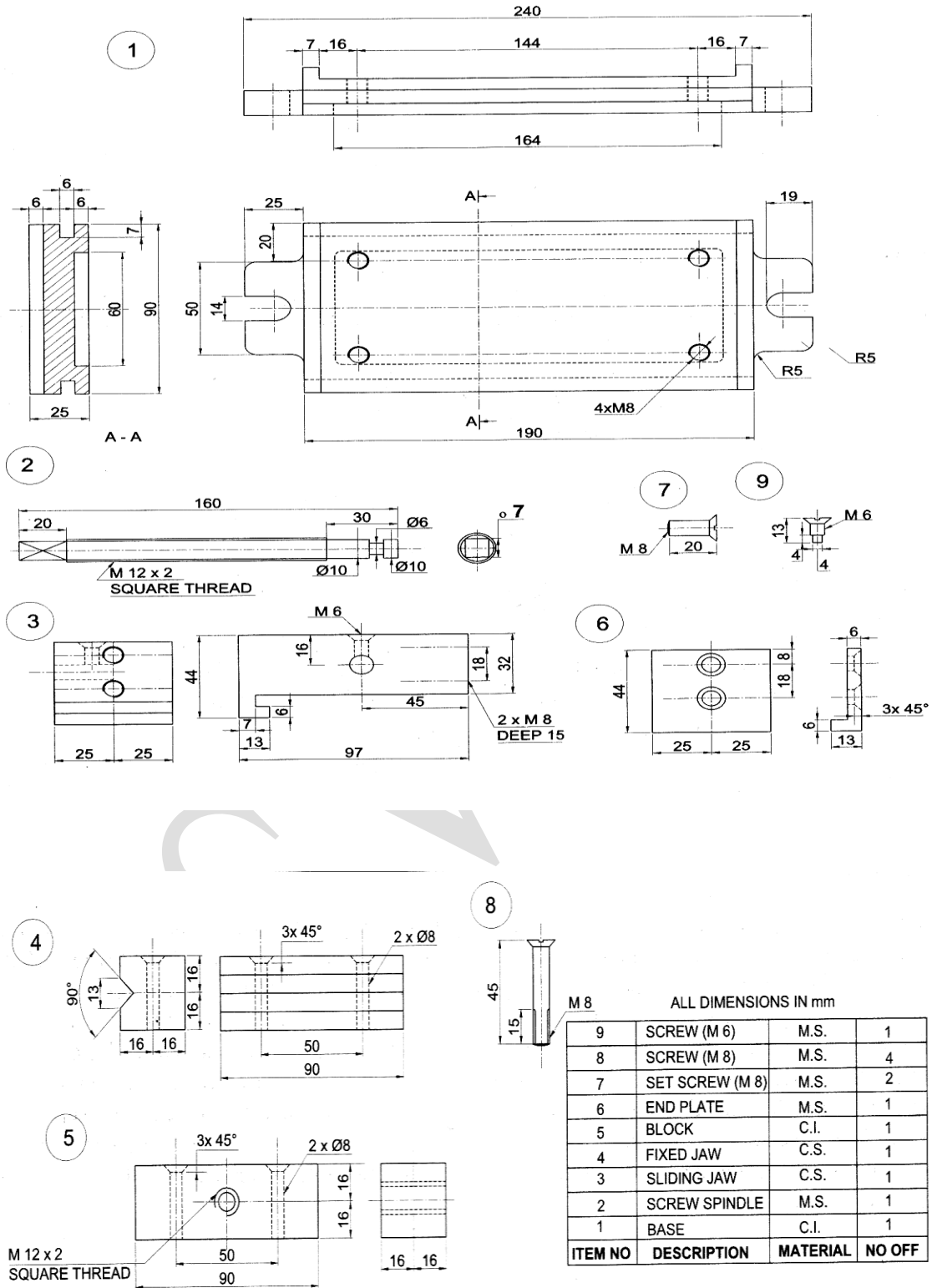
**[Turn over .....**

Sketch A.



Turn over .....

Sketch B.



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VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME206**

**Term : III**

**Course Name : MACHINE DRAWING PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Machine Drawing Practical	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**TOPICS AND ALLOCATION OF HOURS:**

UNIT	Topics	Hours
I	INTRODUCTION	4
II	DRAWING AIDS AND EDITING COMMANDS	4
III	BASIC DIMENSIONING, HATCHING, BLOCKS AND VIEWS	4
IV	ISOMETRIC DRAWING	4
V	CAD DRAWING PRACTICE	74
	<b>TOTAL</b>	90

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C206.1</b>	To know about the basics of autocad software
<b>C206.2</b>	Explain the drawing aids and editing commands
<b>C206.3</b>	Explain dimensioning, hatching, blocks and views in the autocad software
<b>C206.4</b>	Explain the Isometric drawing with various views
<b>C206.5</b>	Draw assembly drawing of the components to give a thorough knowledge of cad drawings

## Course outcomes linkage to Cognitive level:

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO, PSO	Teaching Hrs
C206.1	To know about the basics of autocad software	1,2,3,4,5,6,7,8,9,10	A	PO1, PO2, PO3	4
C206.2	Explain the drawing aids and editing commands	1,2,3,4,5,6,7,8,9,10	A	PO1, PO2, PO3	4
C206.3	Explain dimensioning, hatching, blocks and views in the autocad software	1,2,3,4,5,6,7,8,9,10	A	PO1, PO2, PO3	4
C206.4	Explain the Isometric drawing with various views	-	A	PO1, PO2, PO3	4
C206.5	Draw assembly drawing of the components to give a thorough knowledge of cad drawings	1,2,3,4,5,6,7,8,9,10	R/U/A	PO1, PO2, PO3	74
<b>Total Sessions</b>					90

## Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
MACHINE DRAWING PRACTICAL	3	3	-	-	-	-	1

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**N1ME206 - MACHINE DRAWING PRACTICAL**  
**DETAILED SYLLABUS**

UNIT	Name of the Topics	Hours
<b>I</b>	<b>INTRODUCTION</b> Introduction – History of CAD – Applications – Advantages over manual drafting – Hardware requirements – Software requirements – Windows desktop – CAD screen interface – menus – Tool bars – How to start CAD – How to execute command – types of co-ordinate systems – Absolute – Relative – Polar.	<b>4</b>
<b>II</b>	<b>DRAWING AIDS AND EDITING COMMANDS</b> Creating objects (2D) – Using draw commands – Creating text – Drawing with precision – Osnap options – drafting settings – drawing aids – Fill, Snap, Grid, Ortho lines – Function keys - Editing and modify commands – Object selection methods – Erasing object – Oops - Cancelling and undoing a command – Copy – Move – Array – Offset – Scale – Rotate – Mirror – Break – Trim – Extend – Explode. Divide – Measure – stretch – Lengthen – Changing properties – Color – line types –LT scale – Matching properties – Editing with grips – Pedit – Ddedit – Mledit.	<b>4</b>
<b>III</b>	<b>BASIC DIMENSIONING, HATCHING, BLOCKS AND VIEWS</b> Basic dimensioning – Editing dimensions – Dimension styles – Dimension system variables. Machine drawing with CAD. Creation of blocks – Wblock – inserting a block – Block attributes – Hatching –Pattern types – Boundary hatch – working with layers - Controlling the drawing display – Blipmode – View group commands – Zoom, redraw, regen, regenauto, pan, viewres – Real time zoom. Inquiry groups – calculating area– Distance – Time – Status of drawing – Using calculator.	<b>4</b>
<b>IV</b>	<b>ISOMETRIC DRAWING</b> Isometric drawing – drawing isocircles – dimensioning – isometric objects.	<b>4</b>
<b>V</b>	<b>CAD DRAWING PRACTICE</b> Detailed drawings of following machine parts are to be given to students. Draw the assembled views (two views only) and bill of materials. The elevation / sectional elevation / plan / sectional plan / side view with dimensioning. <b>CAD DRAWING PRACTICE</b> 1. Sleeve and Cotter joint 2. Knuckle joint 3. Screw Jack 4. Foot step bearing 5. Plummer Block 6. Universal Coupling 7. Simple Eccentric 8. Machine Vice 9. Protected type flanged coupling 10. Swivel Bearing <b>ISOMETRIC DRAWING (Not for exam)</b> 11. Drawing – 4 Nos (Taper line, Isocircles, semicircle)	<b>74</b>

## **REFERENCE BOOKS:**

- 1) Inside AutoCAD - D. Raker and H. Rice - BPB Publications, NewDelhi
- 2) Engineering Drawing and Graphics + AutoCAD – K.Venugopal, - New Age International Publications
- 3) AutoCAD with Applications - Sham Tickoo - Tata Mcgraw Hill.

## **LIST OF EQUIPMENTS**

1. Personal computer – 36 Nos.
2. Printer – 1 No.
3. Required Software :  
CAD Package – Sufficient to the strength.

## **END EXAMINATION**

### **Note:**

- All the exercises have to be completed. All the exercises should be given in the question paper and students are allowed to select by a lot.
- Record note book should be submitted during examination.

## **Detailed Allocation of Marks for External Assessment**

<b>Assembled views of a given drawing</b>	<b>(75 Marks)</b>
1. Sectional elevation -	40 Marks
2. Plan -	15 Marks
3. Side view -	15 Marks
Viva voce -	5 Marks
<b>Total -</b>	<b>75 Mark</b>

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VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme** : DIPLOMA IN MECHANICAL ENGINEERING  
**Course code** : N1ME302  
**Term** : III  
**Course Name** : FOUNDRY AND WELDING PRACTICAL

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Foundry and Welding Practical	4	60	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours**

Unit No	Sections	Time(Hrs)
I	FOUNDRY SECTION	30
II	WELDING SECTION	30
	<b>Total Contact Hours</b>	60

**Course Outcomes:**

On successful completion of the course, the student will be able to:

<b>C302.1</b>	Identify the tools and equipments used in Foundry and Welding.
<b>C302.2</b>	Acquire skills in preparation of sand moulds for different patterns.
<b>C303.3</b>	Acquire skills in all types of welding.

**Course outcomes linkage to Cognitive level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Experiments	CL	Linked PO	Teaching Hrs
<b>C302.1</b>	Identify the tools and equipments used in foundry& welding	Foundry: 1,2,3,4,5,6 Welding 1,2,3,4,5,6,7	U/A	PO1,PO4,PO7	12
<b>C302.2</b>	Acquire skills in preparation of sand moulds for different patterns.	Foundry: 1,2,3,4,5,6,	U/A	PO1,PO4,PO7	24
<b>C303.3</b>	Perform various welding operations to make a different types of joints & profile cutting using arc welding (SMAW),MIG welding, plasma cutting and “Oxy fuel” cutting, spot welding	Welding 1,2,3,4,5,6,7	U/A	PO1,PO4,PO7	24
<b>Total sessions</b>					60

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
<b>Foundry and Advanced Welding Practical</b>	3	-	-	3	-	-	3

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

- Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## Foundry Section

1. Introduction of tools and equipment
2. Types of patterns
3. Types of sand
4. Preparation of sand moulds
5. Core sands, preparation of cores

### I. List of Exercises:

Prepare the green sand mould using the following patterns.

#### Solid pattern

1. Stepped pulley **Split pattern**
2. Bent Pipe with core print
3. T-pipes with core print
4. Tumbles

#### Loose Piece Pattern

5. Dovetail

#### Core preparation

6. Core preparation for Bent pipe / T-pipe

## Welding Section

1. Introduction of Safety in welding shop
2. Introduction to hand tools and equipment
3. Arc and gas welding equipment
4. Types of joints

### II. List of Exercises :

Make the following welding joint / cutting.

#### Arc welding (Raw Material: 25 mm x 6mm MS flat)

1. Butt joint
2. T- joint

#### MIG Welding

3. Open corner joint

#### Gas Welding (Raw Material: 25mm x 3mm Ms flat)

4. Lap joint

#### Gas cutting: (GI/MS Sheet - 3mm thickness)

5. Profile cutting – circular profile

#### Spot welding: (GI/MS Sheet)

6. Lap joint

#### Plasma cutting (MS FLAT)

7. Straight Cutting

## LIST OF EQUIPMENTS

### WELDING:

1 . Arc welding booth	- 2Nos with welding transformer
2. Gas welding unit	- 1 Set ( Oxygen and acetylene cylinder)
3. Flux	- Sufficient quantity
4. Electrode	- Sufficient quantity
5. Welding rod	- Sufficient quantity
6. Welding shield	- 5Nos
7. Gas welding goggles	- 5Nos
8. Chipping hammer	- 10Nos
9. Leather Gloves 18’’	- 10 Sets
10. Spot welding machine	- 1 No
11. Personal protective equipment	- Sufficient quantity
12. Fire safety equipment	- Sufficient quantity
13. MIG Welding Machine	- 1No
14. Electrode coil for MIG welding	- Sufficient quantity
15. Plasma cutting unit	- 1No

### FOUNDRY:

1 . Moulding board	- 15Nos.
2. Cope Box	- 15 Nos
3. Drag Box	- 15 Nos
4. Core Box	- 10 Nos
5. Shovel	- 5 Nos
6. Rammer set	- 15 Nos
7. Slick	- 15 Nos
8. Strike-off bar	- 15 Nos
9. Riddle	- 5 Nos
10. Trowel	- 15 Nos
11. Lifter	- 15Nos
12. Cleaning Brush	- 20 Nos
13. Vent rod	- 15 Nos
14. Draw Spike	- 15 Nos
15. Gate cutter	- 15 Nos
16. Runner & Riser	- 15 Nos.each
17. Patterns	- sufficient quantity

## END EXAMINATION

**Note:**

- All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section . All the exercises should be given in the question paper and students are allowed to select by a lot.
- Record note book should be submitted during examination.

### Detailed Allocation of Marks for External Assessment

**Foundry : 35 marks**

Preparation of sand - 10

Ramming and vent holes - 15

Gate cutting / Finish - 10

**Welding : 35 marks**

Edge preparation - 10

Welding / Cutting - 15

Joint strength / Finish - 10

**Viva-voce : 05 marks**

**Total : 75 marks**

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME303**

**Term : III**

**Course Name : LATHE AND DRILLING PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Lathe and Drilling Practical	4	60	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours**

Sl. No	Sections	Time(Hrs)
I	LATHE SECTION	38
II	DRILLING SECTION	22
	<b>Total Contact Hours</b>	60

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C303.1</b>	Identify the parts of a lathe and Drilling
<b>C303.2</b>	Acquire skills on Lathe
<b>C303.3</b>	Acquire skills on drilling machine

## Course Outcome linkage to Cognitive Level:

Cognitive Level Legends: R = Remember U= Understand; A= Application

Course Outcome		Experiment linked	CL	Linked PO	Teaching Hrs
C303.1	Identify the parts of a lathe and Drilling	LATHE: 1,2,3,4,5,6,7,8 DRILLING: 1,2,3,4,	U/A	PO1,PO4,PO7	12
C303.2	Acquire skills on Lathe	1,2,3, 4,5,6,7, 8	U/A	PO1,PO4,PO7	32
C303.3	Acquire skills on drilling machine	1,2,3,4	U/A	PO1,PO4,PO7	16
			<b>Total sessions</b>		<b>60</b>

## Course-PO Attainment Matrix

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Lathe and Drilling Practical	3	-	-	3	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

- Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
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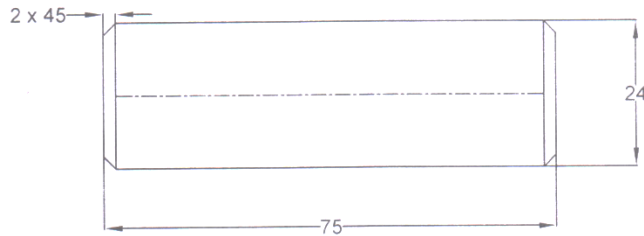
## LATHE SECTION:

1. Introduction of safety in operating lathe machines.
2. Study of lathe and its parts.
3. Types of tools used in lathe work.
4. Study of work holding devices and tool holding devices.
5. Setting of work and tools on a lathe.
6. Operation of lathe.
7. Practice on a lathe
8. Types of measuring instruments and their uses.

**LIST OF EXERCISES:**

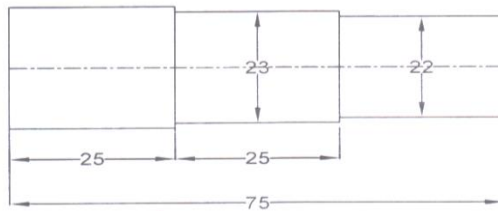
**Make the following jobs in the lathe. Raw material :25 mm dia M.S. Round Rod  
All the dimensions are in mm.**

1. Facing, plain turning & Chamfering

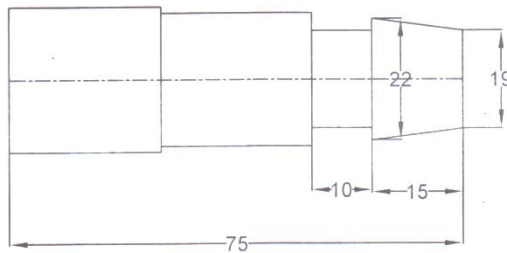


Dimensions			
Sl.No	Part Name	Actual	Obtained

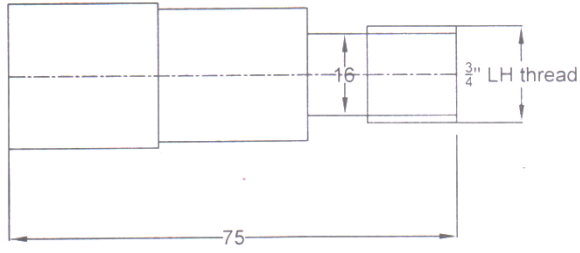
2. Step turning



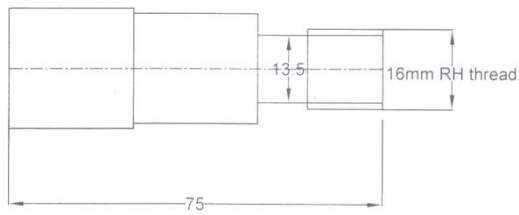
3. Grooving and Taper Turning



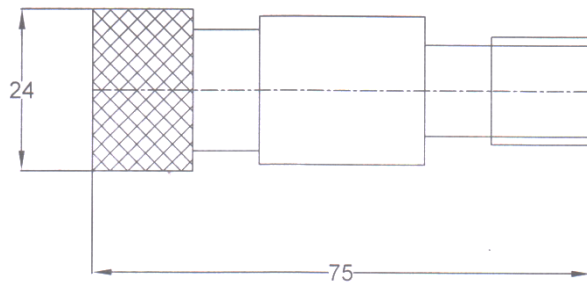
#### 4. LH Thread cutting



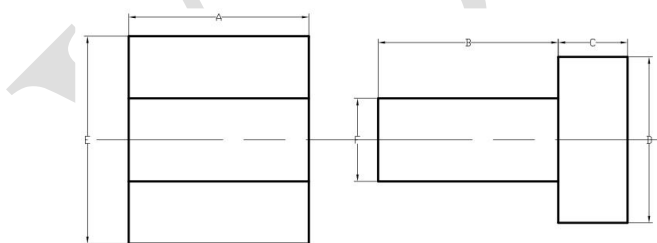
#### 5. RH Thread cutting



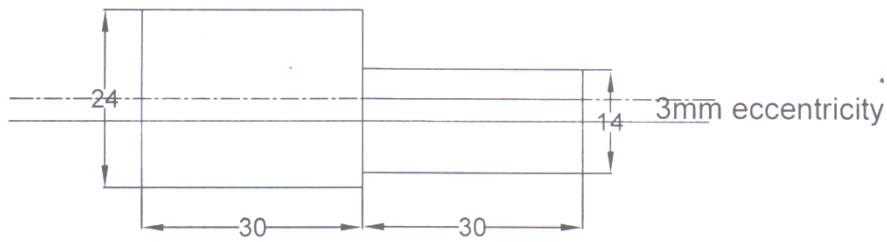
#### 6. Grooving and Knurling



#### 7. Bush: Turning & Drilling



## 8. Eccentric Turning



### DRILLING SECTION:

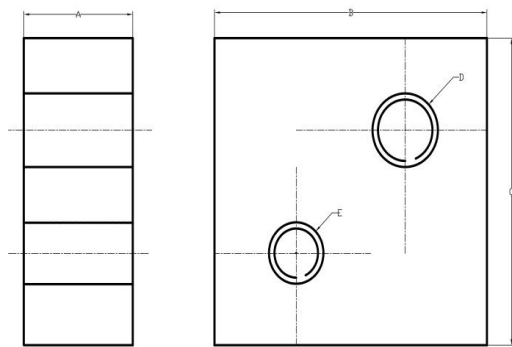
1. Introduction of safety in operating Drilling machines.
2. Study of drilling machines and its parts.
3. Study the types of tools used.
4. Study of work holding devices and tool holding devices.
5. Setting of work and tools.
6. Operation and practice.
7. Types of measuring instruments and their uses.

### LIST OF EXERCISES:

**Make the following jobs in the drilling machine.**

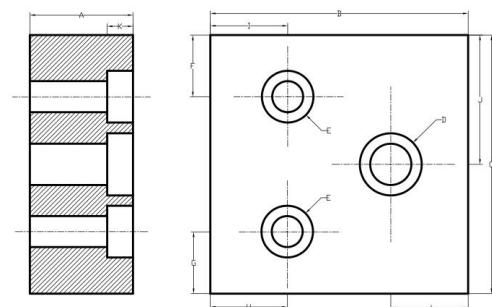
**Raw material 50mm X 50mm X 10mm thick M.S. Flat**

1. Drilling & Tapping in Pillar Drilling Machine

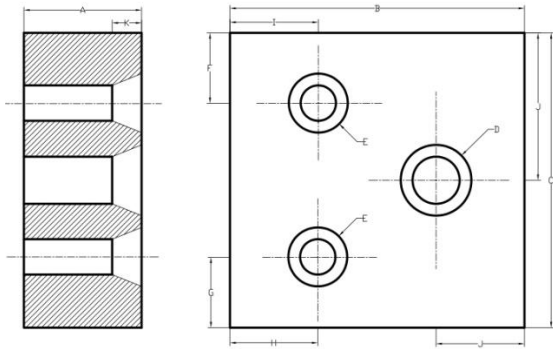


Dimensions			
Sl.No	Part Name	Actual	Obtained

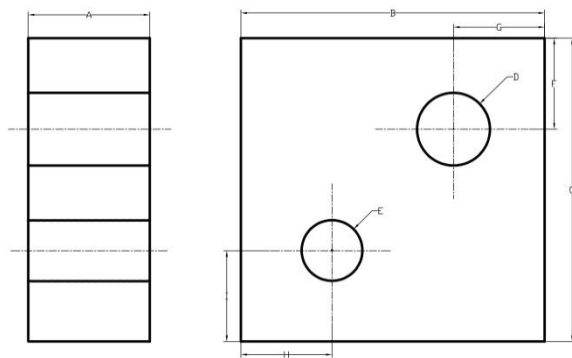
2. Drilling & Counter boring in Pillar Drilling Machine



### 3. Drilling & Counter sinking in Vertical Milling Machine



### 4. Drilling & Reaming in Radial Drilling Machine



## LIST OF EQUIPMENTS

### LATHE SECTION:

1. Lathe (Minimum 4 ½')	-	13 Nos.
2. All geared lathe	-	2 Nos.
3. 4 Jaw / 3 Jaw Chucks	-	Required Numbers
4. Chuck key	-	Required Numbers
5. Spanner	-	Sufficient quantity
6. Cutting Tools	-	Sufficient quantity
7. Pitch gauge	-	5 Nos.
8. Thread gauge	-	5 Nos.
9. Vernier Caliper	-	5 Nos.
10. Snap gauges	-	Sufficient quantity
11. Steel Rule (0-150)	-	Sufficient quantity
12. Calipers (Inside / Outside / Jenny)	-	Sufficient quantity
13. Dial Gauge with Magnetic Stand	-	Sufficient quantity
14. Marking Gauge	-	Sufficient quantity
15. Safety Glass	-	15 Nos.

### DRILLING SECTION:

1. Upright drilling machine	-	2 Nos
2. Radial drilling machine	-	1 Nos
3. Drill bit & Tap set	-	Sufficient quantity
4. Reaming bit	-	Sufficient quantity
5. Counter sinking bit	-	Sufficient quantity
6. Counter boring bit	-	Sufficient quantity
7. Plug gauges	-	Sufficient quantity
8. Vernier Height Gauge	-	1 No.
9. Surface plate	-	1 No.
10. Vertical Milling Machine	-	1 No

## END EXAMINATION

### Note:

- All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot.
- Record note book should be submitted during examination.

### Detailed Allocation of Marks for External Assessment

**Lathe** : 45 marks (2hours)

Procedure / Preparation	
Machining / Dimensions	10
Surface Finishing	25
	10

**Drilling** : 25 marks (1 hour)

Procedure / Marking	10
Dimensions	10
Surface Finishing	5

**Viva-voce** : 05 marks

**Total** : 75 marks

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**N1 - SCHEME**

**Programme** : DIPLOMA IN MECHANICAL ENGINEERING  
**Course code** : N1ME304  
**Term** : III  
**Course Name** : METROLOGY AND METALLOGRAPHY PRACTICAL

**TEACHING AND SCHEME OF EXAMINATIONS:**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Metrology and Metallography Practical	4	60	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours**

Sl. No	Sections	Time(Hrs)
I	METROLOGY SECTION	42
II	METALLOGRAPHY SECTION	18
	<b>Total Contact Hours</b>	60

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C304.1</b>	Familiarize about measuring techniques of metrology instruments.
<b>C304.2</b>	Ability to Compute the Least count of Measuring equipments.
<b>C304.3</b>	Ability to prepare Metallurgical specimen.
<b>C304.4</b>	To deduct the microscope structure of the metals.
<b>C304.5</b>	Conduct the non destructive testing.

## Course outcomes linkage to Cognitive level:

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO, PSO	Teaching Hrs
<b>C304.1</b>	Familiarize about measuring techniques of metrology instruments.	1,2,3,8,9	U/A	PO1, PO3	21
<b>C304.2</b>	Ability to Compute the Least count of Measuring equipments.	4,5,6,7,10,11	U/A	PO1, PO3	21
<b>C304.3</b>	Ability to prepare Metallurgical specimen.	12,13	U/A	PO1, PO3	6
<b>C304.4</b>	To deduct the microscope structure of the metals.	14	U/A	PO1, PO3	6
<b>C304.5</b>	Conduct the non destructive testing.	15,16	U/A	PO1, PO3	6
				<b>Total sessions</b>	<b>60</b>

## Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
METROLOGY AND METALLOGRAPHY PRACTICAL	3	3	-	-	-	-	1

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
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## **METROLOGY SECTION**

- Introduction to linear measurement.
- Introduction to angular measurement.
- Introduction to geometric measurements.
- Study of Least Count of measuring instruments.
- Study of accuracy of instruments and calibration of instruments.
- Study of Linear Measuring Instruments: Vernier Caliper, Micrometer, Inside Micrometer, Vernier Height gauge, Depth Gauge and Slip Gauge, GO & NO GO Gauge, Surface Roughness Tester.
- Study of Angular Measuring Instruments – Universal Bevel Protractor, Sine Bar, Angle Dekkor.
- Study of Geometric measurement - Gear tooth Vernier, Thread Micrometer, Profile Projector.

### **LIST OF EXERCISES**

1. Measure the dimensions of ground MS flat / cylindrical bush using Vernier Caliper compare with Digital / Dial Vernier Caliper.
2. Measure the diameter of a wire using micrometer and compare the result with digital micrometer
3. Measure the thickness of ground MS plates using slip gauges.
4. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
5. Measure the angle of the machined surface using sine bar with slip gauges.
6. Measure the geometrical dimensions of V-Thread using screw thread micrometer.
7. Measure the angle of a machined component by using Angle Dekkor.
8. Measure the geometrical dimensions of spur gear using Gear tooth vernier caliper.
9. Measure the dimension of spur gear using profile projector.
10. Checking the external and internal dimensions of the component using GO & NOGO Gauge.
11. Measurement of Surface Roughness using Surface Roughness Tester.

## METALLOGRAPHY SECTION

- To study the micro structure of the metals using Metallurgical Microscope.
- Determine the micro structure of the ferrous and nonferrous metals.
- Prepare the specimen to study the microstructure.
- Conduct the liquid penetration test to find the crack.
- Conduct magnetic particle test to find cracks.

### **LIST OF EXERCISES**

12. Find the grain structure of the given specimen using the Metallurgical Microscope.
13. Prepare a specimen to examine the micro structure of the Ferrous and Nonferrous metal.
14. Detect the cracks in the specimen using Visual Inspection and ring test.
15. Detect of cracks in specimen using Die penetration test.
16. Detect the cracks in specimen using Magnetic particle test.

### **Content Beyond Syllabus:**

- Image Magnification using Digital Microscope.

### **LIST OF EQUIPMENTS**

1. Vernier Caliper	-	2	Nos.
2. Digital Vernier Caliper.	-	2	Nos.
3. Dial Vernier Caliper.	-	2	Nos.
4. Micrometer	-	2	Nos.
5. Digital Micrometer	-	2	Nos.
6. Slip gauges	-	2	Nos.
7. Universal bevel protractor.	-	2	Nos.
8. Sine bar	-	2	Nos.
9. Thread micrometer	-	2	Nos.
10. Surface plate	-	2	Nos.
11. Vernier height gauge	-	1	No.
12. Metallurgical Microscope.	-	2	Nos.
13. Die penetration	-	2	Nos.
14. Magnetic particle test	-	1	No.

15. Abrasive belt grinder	-	1	No.
16. Polishing machine	-	1	No.
17. Mounting machine	-	1	No.
18. GO & NO GO GAUGE	-	2	Nos.
19. Surface Roughness Tester	-	1	No.
20. Angle Dekkor	-	1	No.
21. Profile Projector	-	1	No.
22. Specimen (Ferrous / Non-ferrous metals)	-	Sufficient quantity	
23. Consumable	-	Sufficient quantity	

**END**  
**EXAMINATI**  
**ON**

**Note:**

- All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot.
- Record note book should be submitted during examination.

**Detailed Allocation of Marks for External Assessment**

<b>Metrology Section</b>	<b>45</b>
Procedure / Least Count	15
Reading / Calculation	20
Result	10
<b>Metallography Section</b>	<b>25</b>
Procedure	10
Preparation and observation	10
Result	5
<b>Viva voce</b>	<b>5</b>
<b>Total</b>	<b>75</b>

**VIRUDHUNAGAR S.VELLAICHAMY NADAR POLYTECHNIC COLLEGE  
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(Affiliated to Directorate of Technical Education, Chennai-25)

VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME305**

**Term : IV**

**Course Name : HEAT POWER ENGINEERING**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Heat Power Engineering	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topics	Hours
I	BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES	18
II	THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION	18
III	AIR COMPRESSORS AND GAS TURBINES	18
IV	FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS	18
V	STEAM BOILERS AND PERFORMANCE OF BOILERS	18
	<b>TOTAL</b>	<b>90</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C305.1</b>	<b>Explain the basics of systems and laws of thermodynamics and thermodynamic processes.</b>	
<b>C305.2</b>	<b>Explain different Air Cycles &amp; combustion of fuels.</b>	
<b>C305.3</b>	<b>Familiarize parts, functions and types of Air compressors and determine their efficiency and Explain various types of gas turbine and its functions.</b>	
<b>C305.4</b>	<b>Acquire the basic knowledge on Steam and its thermodynamic processes.</b>	
<b>C305.5</b>	<b>Compare the performance of various types of Boilers.</b>	

**Course Outcome linkage to Cognitive Level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

<b>Course Outcome</b>		<b>CL</b>	<b>Linked PO</b>	<b>Teaching Hrs</b>
<b>C305.1</b>	<b>Explain the basics of systems and laws of thermodynamics and thermodynamic processes.</b>	<b>R/U/A</b>	PO1, PO2	18
<b>C305.2</b>	<b>Explain different Air Cycles &amp; combustion of fuels.</b>	<b>R/U/A</b>	PO1, PO2	18
<b>C305.3</b>	<b>Familiarize parts, functions and types of Air compressors and determine their efficiency and Explain various types of gas turbine and its functions.</b>	<b>R/U/A</b>	PO1, PO2	18
<b>C305.4</b>	<b>Acquire the basic knowledge on Steam and its thermodynamic processes.</b>	<b>R/U/A</b>	PO1, PO2	18
<b>C305.5</b>	<b>Compare the performance of various types of Boilers.</b>	<b>R/U/A</b>	PO1, PO2	18
			<b>Total sessions</b>	<b>90</b>

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES	18	25	2	3	20	17.86 %
II	THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION	18	25	2	13	10	17.86 %
III	AIR COMPRESSORS AND GAS TURBINES	18	25	2	13	10	17.86 %
IV	FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETERS	18	25	2	3	20	17.86 %
V	STEAM BOILERS AND PERFORMANCE OF BOILERS	18	25	2	13	10	17.86 %
I to V*			15	6	9	0	10.70 %
	<b>Total</b>	<b>90</b>	<b>140</b>	<b>16</b>	<b>54</b>	<b>70</b>	<b>100 %</b>

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
<b>HEAT POWER ENGINEERING</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

*Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.*

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**N1ME305- HEAT POWER ENGINEERING**  
**DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES</b></p> <p><b>Introduction:-</b> Definitions and units of mass, weight, volume, density, specific weight, specific gravity and specific volume – pressure – units of pressure – temperature - absolute temperature – S.T.P and N.T.P conditions – heat - specific heat capacity at constant volume and at constant pressure – work – power – energy – types - law of conservation of energy – thermodynamic system – types – thermodynamic equilibrium - properties of systems – intensive and extensive properties – State of System - process – cycle – point and path functions - Zeroth, first and second laws of thermodynamics.</p> <p><b>Perfect gases:</b> - laws of perfect gases – Boyle’s, Charle’s, Joule’s, Regnault’s and Avogadro’s laws – General Gas Equation -Characteristic gas equation – relation between specific heats and gas constant – Universal gas constant –Change in Internal Energy-enthalpy – change in enthalpy – entropy.</p> <p><b>Thermodynamic processes:-</b> constant volume, constant pressure, constant temp.(isothermal) ,isentropic ( reversible adiabatic ) and, polytropic processes – p-v and t-s diagrams, work done , change in internal energy , heat transfer , change in enthalpy, change in entropy for above processes – simple problems – hyperbolic ,free expansion and throttling processes(description only) .</p> <p><b>Steady flow system:</b> – control volume – steady flow energy equation – assumptions – engineering applications.</p>	<b>18</b>
<b>II</b>	<p><b>THERMODYNAMIC AIR CYCLES AND FUELS &amp; COMBUSTION</b></p> <p><b>Air cycles:</b> – air standard efficiency – reversible and irreversible processes – assumptions in deriving air standard efficiency – Carnot cycle – Otto cycle – Diesel cycle - Comparison of ideal and actual p-v diagrams of Otto and Diesel cycles – Simple problems</p> <p><b>Fuels &amp; Combustion:</b> Classifications of fuels - merits and demerits – requirements of a good fuel – Octane number – detonation – Pre-ignition – Cetane number – Diesel knock – comparison of detonation and diesel knock - fuel additives – Stages of Combustion – Delay period – Variables affecting delay period – Methods of generating air swirl in diesel engine combustion chambers – Types of combustion chambers – combustion equations – stoichiometric air required for complete combustion of fuels – excess air – products of combustion – analysis of exhaust gases - calorific value of fuels.</p>	<b>18</b>
<b>III</b>	<p><b>AIR COMPRESSORS AND GAS TURBINES</b></p> <p><b>Air Compressors:-</b> Uses of compressed air – classifications of Air compressor – reciprocating compressor - single stage reciprocating compressor – compression processes – clearance volume and its effects – volumetric efficiency – multi stage compression – merits and demerits – Two stage compressor with imperfect cooling- with perfect inter cooling – rotary compressors – Roots blower - vane blowers – centrifugal and axial flow air compressors – simple problems.</p>	<b>18</b>

	Gas turbines – uses - classifications – merits and demerits - constant pressure combustion gas turbine – gas turbine with intercooler, reheater, regenerator - effects – closed cycle gas turbines - merits and demerits – jet propulsion - turbojet engines – turbo propeller engines – ramjet – Working principle - merits and demerits – Rocket engines – applications of rockets.	
<b>IV</b>	<p><b>FORMATION &amp; PROPERTIES OF STEAM AND STEAM CALORIMETERS</b></p> <p>Steam - Properties – formation of steam – saturation temperature – enthalpy of water – enthalpy of evaporation – conditions of steam – dryness fraction – enthalpy of wet, dry and superheated steam -advantages of superheated steam – p-v diagram - T-H diagram –</p> <p>T-S diagram - H-S diagram – P-H diagram – critical conditions of water – specific volume of water and steam – density of steam – external work done during evaporation – internal latent heat – internal energy of steam – entropy of water and steam – steam tables - Mollier chart.</p> <p><b>Expansion process of Steam:</b> Constant Volume process – Constant Pressure Process – Constant Temperature process – Hyperbolic Process – Isentropic process – Polytropic process – Throttling process. – Simple problems.</p> <p><b>Steam Calorimeter:</b> Determination of dryness fraction of steam – bucket calorimeter - combined separating and throttling calorimeters.</p>	<b>18</b>
<b>V</b>	<p><b>STEAM BOILERS AND PERFORMANCE OF BOILERS</b></p> <p><b>Steam Boilers:</b> Introduction - Classification of boilers – comparison of fire tube and water tube boilers – high pressure boilers – advantages of high pressure boilers - Lamont and BHEL high pressure boilers – boiler mountings and accessories - function -construction and working – comparison of mountings and accessories – feed water treatment – internal and external treatments - starting boiler from cold condition – safety precautions in boiler operation – causes of Indian boiler act.</p> <p><b>Performance of boilers:</b> Evaporation rate - actual, equivalent and factor of evaporation – boiler efficiency – factors influencing boiler efficiency - boiler power – Simple problems – boiler plant - efficiency of economizer and super heater – Simple problems - boiler trial – heat losses in a boiler- heat balance sheet – Simple problems</p>	<b>18</b>

**Text Books:**

- 1) Thermal Engineering, R.K .Rajput ,8<sup>th</sup> Edition, Laxmi publications Pvt Ltd, New Delhi.
- 2) Applied Thermodynamics, P.K. Nag, 2<sup>nd</sup> Edition, TATA Mcgraw - Hill Publishing Company, New Delhi .
- 3) Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18<sup>th</sup> Edition, S.Chand & Co, NewDelhi.

**Reference Books:**

- 1) Thermal Engineering ,P.L.Ballaney , 24<sup>th</sup> Edition ,Khanna Publishers, New Delhi.
- 2) Thermal Engineering ,B.K. Sarkar , 3<sup>rd</sup> Edition , DhanpatRai& Sons New Delhi .
- 3) Applied Thermodynamics, Domkundwar and P.Kothandaraman, 2<sup>nd</sup> Edition, Khanna publishers, New Delhi.

## MODEL QUESTION PAPER-I

Term : IV  
Programme : Diploma in Mechanical Engineering  
Course : Heat Power Engineering

Time : 3 Hours  
Max. Marks: 75  
Course Code: N1ME305

- [ **N.B:** (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B and 10 Marks in PART – C.  
(4) Steam tables and Mollier diagram are permitted]

### PART – A

1. State Zeroth Law of thermodynamics.
2. What is control volume?
3. Draw P-V and T-S diagram of Otto Cycle.
4. What is meant by excess air?
5. Define volumetric efficiency.
6. What is meant by wet steam?
7. Write the uses of steam calorimeters.
8. Define boiler efficiency.

### PART – B

9. Define the terms system, boundary and surrounding.
10. What is meant by Intensive property? Give two examples.
11. Write down the assumptions made in deriving Air Standard Efficiency.
12. What are the requirements of a good fuel?
13. Write down the uses of Compressed Air.
14. Mention the uses of Mollier chart.
15. What is meant by boiler mountings? Name any three boiler mountings.
16. Steam is at a pressure of 8 bar absolute and 0.8 dry. Find the entropy of steam.

**PART – C**

17. (a)  $0.35\text{m}^3$  of air at  $22^\circ\text{C}$  and Under atmospheric pressure is heated under constant volume to a temperature of  $100^\circ\text{C}$ . Determine (i) mass of air, (ii) the final pressure (iii) heat transfer (iv) change in internal energy (v) work done (vi) change in enthalpy (vii) Change in entropy. Assume  $C_p=1\text{ KJ/KgK}$ ,  $C_v=0.71\text{ KJ/KgK}$ .

(Or)

- (b) (i) Derive the Relationship between Specific heats and Gas Constant.  
(ii) State and Explain the Different types of Thermodynamics system with examples.

[ Turn over .....

-2-

18. (a) Determine the work done and air standard efficiency of an engine working on Otto cycle with compression ratio 7 and the minimum temperature and maximum temperature being  $40^\circ\text{C}$  and  $1250^\circ\text{C}$ . Assume  $C_p = 1.005\text{ KJ/KgK}$ ,  $C_v = 0.71\text{ KJ/KgK}$ .

(Or)

- (b) A fuel contains 92% carbon, 4% hydrogen, 2% sulphur, 1.5% oxygen and 0.5% ash. It is supplied with 50% excess air. Determine the total air and also gravimetric composition of the products of combustion.

19. (a) A two stage air compressor works between 1 bar and 16 bar. The inlet temperature of air is  $30^\circ\text{C}$ . Determine the exit temperature of air, if intercooling is perfect and compression is isentropic. Also find the work done per kg of air without intercooling.

(Or)

- (b) Explain the working Ramjet engine with a neat sketch.

20. (a) Calculate the Internal Energy per kg of steam at pressure of 15 bar exists in the following two conditions (i) wet steam with dryness fraction 0.8, (ii) super heated steam with temperature  $215^\circ\text{C}$ . Assume  $C_{ps} = 2.2\text{ KJ/KgK}$ .

(Or)

- (b) Explain with neat sketch the working of combined separating and throttling calorimeter

21. (a) Explain with neat sketch the working of Lamont boiler.

(Or)

- (b) Write the clauses of Indian boiler act.

## MODEL QUESTION PAPER-II

Term : IV  
Programme : Diploma in Mechanical Engineering  
Course : Heat Power Engineering

Time : 3 Hours  
Max. Marks : 75  
Course Code: N1ME305

- [ **N.B:** (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B and 10 Marks in PART – C.  
(4) Steam tables and Mollier diagram are permitted]

### PART – A

1. State first Law of thermodynamics.
2. What are the applications of SFEE?
3. Define Air Standard Efficiency.
4. What is meant by detonation?
5. Write the effect of clearance volume in a compressor.
6. Define dryness fraction.
7. What is meant by throttling process?
8. What is a fire tube boiler?

### PART – B

9. Define the terms point function and path function.
10. What is meant by Extensive property? Give two examples.
11. Draw P-V and T-S diagram of Diesel Cycle. Mention the processes of Diesel cycle.
12. What are the requirements of a good fuel?
13. Write down the uses of Compressed Air.
14. Define critical point, critical pressure, critical temperature of water.
15. What are the safety precautions in boiler operation?
16. Steam is at a pressure of 9 bar absolute and 0.96 dry. Find the enthalpy of steam.

**PART – C**

17. (a) One kg of air at 11 bar and 80° C is expanded to 10 times the original volume by  
(i) Isothermal process (ii) Isentropic process. Determine the work done in each of the cases,  $R=287 \text{ J/Kg K}$ ,  $\gamma =1.4$ .  
(Or)
- (b) (i) To prove:  $PV= mRT$   
(ii) To prove:  $C_p -C_v =R$

[ Turn over ....

-2-

18. (a) In a Diesel Engine, the compression Ratio 18:1 and the fuel is Cutoff at 8% of Stroke. Find the air Standard efficiency of the Engine. Take  $\gamma=1.4$  for air.  
(Or)
- (b) A fuel contains 92% carbon, 4% hydrogen, 2% sulphur, 1.5% oxygen and 0.5% ash. It is supplied with 50% excess air. Determine the total air and also gravimetric composition of the products of combustion.
19. (a) A two stage air compressor works between 1 bar and 16 bar. The inlet temperature of air is 30°C. Determine the exit temperature of air, if intercooling is perfect and compression is isentropic. Also find the work done per kg of air without intercooling.  
(Or)
- (b) Explain the working Turbojet engine with a neat sketch.
20. (a) Calculate the internal energy per kg of steam at a pressure of 10 bar abs, when the steam is (a) 85 % dry (b) dry and saturated (c) super heated with degree of super heat being 50 °C. Assume  $C_{ps}=2.26 \text{ KJ/kgK}$ .  
(Or)
- (b) One kg of water at 95° C is heated under a constant pressure of 17.5 bar absolute until it is converted into steam with dryness fraction 0.98. Determine the work done, heat added, change in internal energy and change in entropy.
21. (a) Explain with neat sketch the working of BHEL boiler.  
(Or)
- (b) . Following data were obtained in a boiler trial.
- Feed water supplied per hour - 690 Kg at 28° C,
  - Steam produced 0.97 dry at 8 bar,
  - Coal fired per hour - 91kg of calorific value 27200 KJ/Kg,
  - Ash and Unburnt Coal collected is 7.5 Kg/hour of calorific Value 2700 KJ/Kg,
  - Mass of flue gases per Kg of Coal burnt -17.4 kg,
  - Temperature of flue gases - 325° C,
  - Room Temperature - 17° C,
  - Specific heat of flue gases is 1.005KJ/KgK,
- Estimate boiler efficiency and draw heat balance sheet.

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**N1 - SCHEME**

**Programme** : DIPLOMA IN MECHANICAL ENGINEERING  
**Course code** : N1ME306  
**Term** : IV  
**Course Name** : SPECIAL MACHINES

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Special Machines	5	75	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

Unit	Topics	Hours
I	MANUFACTURING OF PLASTIC COMPONENTS AND COMPOSITE MANUFACTURING	15
II	RECIPROCATING MACHINES AND BROACHING MACHINE	15
III	MILLING MACHINES AND GEAR GENERATING PROCESSES	15
IV	ABRASIVE PROCESS AND NON- CONVENTIONAL MACHINING PROCESSES	15
V	CNC MACHINE AND ITS COMPONENTS	15
	<b>TOTAL</b>	<b>75</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C306.1</b>	Acquire knowledge about the types of plastics, properties and its processes and composite materials.
<b>C306.2</b>	Understanding the working of reciprocating machines.
<b>C306.3</b>	Understanding the working of milling machine and milling cutters and types of gear generating and finishing processes.
<b>C306.4</b>	Understanding the Abrasive process & Process Machines, Non Conventional Machining Process.
<b>C306.5</b>	Study of working principle of CNC machine and its components.

**Course Outcome linkage to Cognitive Level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
<b>C306.1</b>	Acquire knowledge about the types of plastics, properties and its processes and composite materials.	<b>R/U/A</b>	PO1, PO2	15
<b>C306.2</b>	Understanding the working of reciprocating machines.	<b>R/U/A</b>	PO1, PO2	15
<b>C306.3</b>	Understanding the working of milling machine and milling cutters and types of gear generating and finishing processes.	<b>R/U/A</b>	PO1, PO2	15
<b>C306.4</b>	Understanding the Abrasive process & Process Machines, Non Conventional Machining Process.	<b>R/U/A</b>	PO1, PO2	15
<b>C306.5</b>	Study of working principle of CNC machine and its components..	<b>R/U/A</b>	PO1, PO2	15
			<b>Total sessions</b>	75

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	MANUFACTURING OF PLASTIC COMPONENTS AND COMPOSITE MANUFACTURING	15	25	2	23	-	17.86 %
II	RECIPROCATING MACHINES AND BROACHING MACHINE	15	25	2	23	-	17.86 %
III	MILLING MACHINES AND GEAR GENERATING PROCESSES	15	25	2	23	-	17.86 %
IV	ABRASIVE PROCESS AND NON-CONVENTIONAL MACHINING PROCESSES	15	25	2	23	-	17.86 %
V	CNC MACHINE AND ITS COMPONENTS	15	25	2	23	-	17.86 %
I to V*			15	6	9	-	10.70 %
	<b>Total</b>	<b>75</b>	<b>140</b>	<b>16</b>	<b>124</b>	<b>-</b>	<b>100 %</b>

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
<b>SPECIAL MACHINES</b>	<b>3</b>	<b>3</b>	-	-	-	-	-

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**N1ME306 - SPECIAL MACHINES**  
**DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>MANUFACTURING OF PLASTIC COMPONENTS</b></p> <p><b>Plastic Components:</b> Types of plastics - Engineering plastics – thermosets – composite - structural foam, elastomers - polymer alloys and liquid crystal polymers. Factors Influencing the Selection Of Plastics - Mechanical properties – degradation - wear resistance - frictional properties - special properties –processing – cost</p> <p><b>Processing of Plastics:</b> Extrusion-general features of single screw extrusion -twin screw extruders. Injection moulding types: Plunger type - Reciprocating screw injection - details of injection mould - structural foam injection mould - sandwich moulding - gas injection moulding -injection moulding of thermosetting materials - calendaring and rotational moulding. Design consideration for plastic components.</p> <p><b>Composite manufacturing:</b> Introduction – characteristics of composite manufacturing - constituents – Glass fibers manufacturing process – hand laminating process – autoclave processing – filament winding – pultrusion process – liquid composite process – working principles by schematic diagram only – advantages – disadvantages.</p>	<b>15</b>
<b>II</b>	<p><b>RECIPROCATING MACHINES</b></p> <p><b>Planer:</b> Introduction - description of double housing planer – specifications -principles of operation – drives - quick return mechanism - feed mechanism - work holding devices and special fixtures - types of tools - operations.</p> <p><b>Shaper:</b> Introduction – specifications – principles of operations standard shaper – quick return mechanism - crank and slotted link – hydraulic shaper - feed mechanism - work holding devices – fixture -operations.</p> <p><b>Slotter:</b> Introduction – specifications - method of operation - Whitworth quick return mechanism - feed mechanism - work holding devices -types of tools.</p> <p><b>Broaching:</b> Types of broaching machine - horizontal, vertical and continuous broaching - principles of operation - types of broaches – classification - broach tool nomenclature - broaching operations</p>	<b>15</b>
<b>III</b>	<p><b>MILLING MACHINES AND GEAR GENERATING PROCESSES</b></p> <p><b>Milling Machines:</b> Types - column and knee type – plain - universal milling machine - vertical milling machine - principles of operation - specification of milling machines - work holding devices - tool holding devices - arbor - stub arbor - spring collet – adapter.</p> <p><b>Milling cutters:</b> cylindrical milling cutter - slitting cutter -side milling cutter - angle milling cutter - T-slot milling cutter - woodruff milling cutter - fly cutter -nomenclature of cylindrical milling cutter.</p> <p><b>Milling operations:</b> straddle milling - gang milling - vertical milling</p>	<b>15</b>

	<p>attachment. Indexing plate – differential indexing - simple indexing – compound indexing – simple problems.</p> <p><b>Generating Process:</b> gear shaper - gear hobbing - principle of operation only.</p> <p><b>Gear finishing processes:</b> burnishing – shaving -grinding and lapping - gear materials.</p>	
IV	<p><b>ABRASIVE PROCESS AND NON- CONVENTIONAL MACHINING PROCESSES</b></p> <p><b>Abrasive Process:</b> Types and classification – specifications - rough grinding – pedestal grinders - portable grinders - belt grinders - precision grinding - cylindrical grinder - centerless grinders – surface grinder - tool and cutter grinder - planetary grinders - principles of operations - grinding wheels – abrasives - natural and artificial diamond wheels - types of bonds - grit, grade and structure of wheels - wheel shapes and sizes - standard marking systems of grinding wheels - selection of grinding wheel - mounting of grinding wheels - Dressing and Truing of wheels - Balancing of grinding wheels.</p> <p><b>Non-Conventional Machining Processes:</b> Construction, working and applications of Ultrasonic machining - chemical machining - electro chemical grinding - electrical discharge machining - plasma arc machining - LASER machining - Advantages – Disadvantages.</p>	15
V	<p><b>CNC MACHINE AND ITS COMPONENTS</b></p> <p><b>CNC Machines:</b> Numerical control – definition – working principle of a CNC system – Features of CNC machines - advantage of CNC machines – difference between NC and CNC – Construction and working principle of turning centre – Construction and working principle of machining centre – machine axes conventions turning centre and machining centre – Coordinate measuring machine – construction and working principle.</p> <p><b>Components of CNC machine:</b> Slide ways – requirement – types – friction slide ways and antifriction slide ways - linear motion bearings – recirculation ball screw – ATC – tool magazine – feedback devices – linear and rotary transducers – Encoders - in process probing - tool material – tool inserts.</p>	15

**Text Books:**

1. Elements of Workshop Technology- Vol. I & II, Hajra Choudry & Battacharya, Edn. 11, published by Media Promoters and Publishers Pvt. Ltd., Seervai Buildings 'B', 20-G, Noshir Bharucha Marg, Mumbai 400 007 – 2007.
2. Production Technology, Jain & Gupta, Khanna Publishers, 2-B, North Market, Naisarak, New Delhi – 110 006 – 2006.

**Reference Books:**

1. Production Technology, HMT, Edn. 18, published by Tata McGraw Hill Publishing Co. Ltd., 7, West Patel Nagar, New Delhi 110 008.
2. Manufacturing process, Myro N Begman, , Edn. 5, Tata McGraw Hill Publishing Co. Ltd., 7, West Patel Nagar, New Delhi 110 008.
3. Workshop Tech Vol I,II, III, WAJ. Chapman, published by Viva Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
4. Production processes, NITTTR, published by 5, Tata McGraw Hill Publishing Co. Ltd., West Patel Nagar, New Delhi 110 008.
5. Principles of the manufacturing of Composite materials – Suong V Hoa, DES tech publication. Inc, 439, North Duke street, Lancaster, Pennsylvania – 17602 U.S.A.

VSVNPC

## MODEL QUESTION PAPER-I

Term : IV

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks: 75

Course : Special Machines

Course Code: N1ME306

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What is plastic?
2. Write main constituents of composite.
3. What is shaper?
4. List the part of a planner.
5. What is gear hobbing?
6. What is electrochemical grinding?
7. Draw the axis convention for turning centre.
8. List the types of slide ways.

### PART – B

9. List the various production processes of plastics.
10. Mention the advantage of filament method.
11. Explain any two shaping operations.
12. Explain principle of operation of milling machine.
13. What is gear generating process? List them.
14. List the advantage of Ultrasonic machining.
15. List out the advantage of CNC machines.
16. Differentiate between NC and CNC system.

**[Turn over .....**

-2-  
**PART – C**

17. (a) Explain design considerations for plastic components.

*(Or)*

(b) Explain glass fibre manufacturing process.

18. (a) Explain the quick return mechanism of a shaper.

*(Or)*

(b) Sketch and describe the nomenclature of a broach tool.

19. (a) Explain any form milling operations.

*(Or)*

(b) Explain bevel gear generation process with sketch.

20. (a) Sketch and describe the method of dressing and turning of a grinding wheel.

*(Or)*

(b) Explain with a sketch, the working of laser beam machining.

21. (a) What are transducers? Explain working of rotary transducer.

*(Or)*

(b) What are different configurations of CMM? With neat sketch explain any one in detail.

## MODEL QUESTION PAPER-II

Term : IV

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks: 75

Course : Special Machines

Course Code: N1ME306

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. Mention any two advantages of structural foam injection moulding.
2. Define Quick return mechanism.
3. What is shaper?
4. List the types of broaching machines.
5. List the main parts of a horizontal spindle surface grinder.
6. Give the expansion of laser?
7. What is a tool magazine?
8. State any two advantages of gear shaping.

### PART – B

9. Sketch and show the parts of calendaring.
10. List the advantages of hydraulic drive of a shaper.
11. Name the main parts of a double housing planner.
12. Mention the different milling cutters.
13. Write short notes on gear materials.
14. State the mechanism of metal removal in EDM
15. How are automatic tool changers classified.
16. Sketch and show the main parts of chemical machining.

[Turn over .....

**PART – C**

17. (a) With a simple sketch, explain rotational moulding.

(Or)

(b) Explain the manufacturing process of glass fibers with a schematic diagram.

18. (a) Explain with a neat sketch, the crank and slotted link quick return mechanism of a shaper

(Or)

(b) With suitable diagram, explain the following continuous broaching machines.

19. (a) Describe the nomenclature of cylindrical milling cutter.

(Or)

(b) Explain gear hobbing with a suitable diagram.

20. (a) With a suitable sketch, explain the external centre less grinding.

(Or)

(b) Explain with a sketch, the working of laser beam machining.

21. (a) What are transducers? Explain working of rotary transducer.

(Or)

(b) Explain any two types of tool magazines with diagram.

**VIRUDHUNAGAR S.VELLAICHAMY NADAR POLYTECHNIC COLLEGE  
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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME307**

**Term : IV**

**Course Name : FLUID MECHANICS AND FLUID POWER**

**TEACHING AND SCHEME OF EXAMINATIONS:**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Fluid Mechanics and Fluid Power	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topics	Hours
I	PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS	18
II	FLOW OF FLUIDS AND FLOW THROUGH PIPES	18
III	IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS	18
IV	PNEUMATIC SYSTEMS	18
V	HYDRAULIC SYSTEMS	18
	<b>TOTAL</b>	90

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C307.1</b>	<b>Study the properties of Fluids and understand the pressure measuring devices.</b>
<b>C307.2</b>	<b>Explain the continuity equation and Bernoulli's theorem and understand Coefficient of Discharge, co-efficient of contraction and coefficient of velocity of orifice meter, frictional loss of head in flow through pipes.</b>
<b>C307.3</b>	<b>Explain the working of hydraulic turbines, pumps and impact of Jets.</b>
<b>C307.4</b>	<b>Understand the elements and circuits of pneumatic system.</b>
<b>C307.5</b>	<b>Understand the elements and circuits of Hydraulic system</b>

**Course Outcome linkage to Cognitive Level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application`**

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
<b>C307.1</b>	<b>Study the properties of Fluids and understand the pressure measuring devices.</b>	<b>R/U/A</b>	PO1, PO2	18
<b>C307.2</b>	<b>Explain the continuity equation and Bernoulli's theorem and understand Coefficient of Discharge, co-efficient of contraction and coefficient of velocity of orifice meter, frictional loss of head in flow through pipes.</b>	<b>R/U/A</b>	PO1, PO2,	18
<b>C307.3</b>	<b>Explain the working of hydraulic turbines, pumps and impact of Jets.</b>	<b>R/U/A</b>	PO1, PO2	18
<b>C307.4</b>	<b>Understand the elements and circuits of pneumatic system.</b>	<b>R/U/A</b>	PO1, PO2	18
<b>C307.5</b>	<b>Understand the elements and circuits of Hydraulic system</b>	<b>R/U/A</b>	PO1, PO2. PO7	18
			<b>Total sessions</b>	90

### Course Content and Blue Print of Marks for End Examination:

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS	18	25	2	18	5	17.86
II	FLOW OF FLUIDS AND FLOW THROUGH PIPES	18	25	2	18	5	17.86
III	IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS	18	25	2	18	5	17.86
IV	PNEUMATIC SYSTEMS	18	25	2	18	5	17.86
V	HYDRAULIC SYSTEMS	18	25	2	18	5	17.86
I to V*		18	15	6	9	0	10.70
	<b>Total</b>	<b>90</b>	<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100</b>

\*3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each

### Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Fluid Mechanics and Fluid Power	3	3					1

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**N1ME307 - FLUID MECHANICS AND FLUID POWER**  
**DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS</b></p> <p>Introduction - Definition of fluid - Classification of Fluids - ideal and real fluids - Properties of a fluid – definition and units - Pressure-units of Pressure - Pressure head-atmospheric, gauge and absolute pressure – problems - Pascal’s law- proof - applications of Pascal’s law - Hydraulic press - Hydraulic jack - Pressure measurement -Piezometer tube - Simple U-tube manometer - Differential U-tube manometer - Inverted Differential manometer - Micro-manometer -Inclined tube micro-manometer - Mechanical Gauges -Bourdon’s Tube Pressure Gauge - Diaphragm pressure gauge - Dead weight pressure gauge.</p>	<b>18</b>
<b>II</b>	<p><b>FLOW OF FLUIDS AND FLOW THROUGH PIPES</b></p> <p>Types of fluid flow - path line and stream line - mean velocity of flow -discharge of a flowing fluid - equation of continuity of fluid flow -energies of fluid - Bernoulli’s theorem - statement, assumptions and proof - applications and limitations of Bernoulli’s theorem - problems on Bernoulli’s theorem – venturimeter - derivation for discharge -orifice meter - derivation for discharge - difference between venturimeter and orifice meter - problems on venturimeter and orifice meter - Pitot tube – description only – orifice –types – applications -hydraulic co-efficient - determining hydraulic co-efficient – problems -discharge through a small orifice discharging freely only - problems – experimental method of finding <math>C_v</math>, <math>C_c</math> and <math>C_d</math> - Flow through pipes -laws of fluid friction - hydraulic gradient line - total energy line -wetted perimeter - hydraulic mean radius - loss of head due to friction – Darcy - Weisbach equation and Chezy’s formula –problems - minor losses (description only) - Power transmission through pipes - problems.</p>	<b>18</b>

<p><b>III</b></p>	<p><b>IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS</b></p> <p>Impact of jet - on a stationary flat plate held normal to the jet and inclined to the direction of jet - Impact of jet on a flat plate moving in the direction of jet - Impact of jet on a series of moving plates or vanes - force exerted and work done by the jet - problems. Hydraulic turbines – classifications - Pelton wheel- components and working -speed regulation (theory only)- Francis and Kaplan turbines -components and working - draft tube - functions and types - surge tank - differences between impulse and reaction turbines. Centrifugal Pumps– classifications- construction and working of single stage centrifugal pumps - components with types - theory only - multi stage pumps – advantages - priming – cavitation. Reciprocating Pumps – classifications - construction and working of single acting and double acting reciprocating pumps - plunger and piston pumps - discharge of a reciprocating pump - theoretical power required - coefficient of discharge – slip – problems - negative slip -indicator diagram – separation - air vessel (functions and working) -Special pumps - Jet pump - Turbine pump - Submersible pump.</p>	<p><b>18</b></p>
<p><b>IV</b></p>	<p><b>PNEUMATIC SYSTEMS</b></p> <p>Pneumatic Systems – elements – filter – regulator - lubricator unit - pressure control valves - pressure relief valves - pressure regulation valves - directional control valves - 3/2 DCV - 5/2 DCV – 5/3 DCV flow control valves – throttle valves –shuttle valves – quick exhaust valves –ISO symbols of pneumatic components – pneumatic circuits – direct control of single acting cylinder – operation of double acting cylinder – operation of double acting cylinder with metering-in control - operation of double acting cylinder with metering-out control – use of shuttle valve in pneumatic circuits – use of quick exhaust valve in pneumatic circuits - automatic operation of double acting cylinder single cycle – multiple cycle – merits and demerits of pneumatic system - applications.</p>	<p><b>18</b></p>
<p><b>V</b></p>	<p><b>HYDRAULIC SYSTEMS</b></p> <p>Hydraulic system – Merits and demerits – Service properties of hydraulic fluids Hydraulic accumulators – Weight of gravity type accumulator – Spring loaded type accumulator - Gas filled accumulator – Pressure intensifier – Fluid power pumps – External and internal gear pump, Vane pump, Radial piston pump – ISO symbols for hydraulic components – Hydraulic actuators – Cylinders and motors – Valves – Pressure control valves, Flow control valves and direction control valves – types – including 4/2 DCV and 4/3 DCV – their location in the circuit.</p> <p>Hydraulic operation of double acting cylinder with metering-in and metering-out control – application of hydraulic circuits – Hydraulic circuit for - shaping machine - table movement in surface grinding machine and milling machine – comparison of hydraulic and pneumatic systems.</p>	<p><b>18</b></p>

**Text Books:**

- 1) A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, R.S. Khurmi, - Edn.18, S.Chand & Co., Ram Nagar, New Delhi – 110 055, Ram Nagar, New Delhi
- 2) A Text Book of Fluid Mechanics and Hydraulic Machines – by, R. K Rajput and S.Chand & Co,Ram Nagar, New Delhi – 110 055.

**Reference Books:**

- 1) Hydraulic Machines, Jagadishlal, , Metropolitan Book Co. Pvt. Ltd., 1, Faiz Bazaar, New Delhi – 110 006.
- 2) Hydraulics,Andrew Parr (A Technician's and Engineer's Guide)
- 3) Fundamentals of pneumatic control Engineering -FESTO Manual
- 4) Fluid Mechanics and Hydraulic Machines,R. K. Bansal, Laxmi Publications Pvt.,Ltd,22,Golden House, Daryaganj, New Delhi – 110 002

VSVNPC

## MODEL QUESTION PAPER-I

Term : IV

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks: 75

Course : Fluid Mechanics and Fluid Power

Course Code: N1ME307

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. Define specific gravity.
2. Define pressure.
3. What is an orifice?
4. State any two application of Bernoulli's theorem
5. Define slip
6. State the function of draft tube?
7. Name any two types of hydraulic accumulator
8. What is check valve and draw its ISO symbol?

### PART – B

9. What is a real fluid give example?
10. List the applications of Pascal's law.
11. State and prove Bernoulli's theorem?
12. Compare venture meter and orifice meter.
13. What are the functions of Draft tube? Sketch any two types
14. Sketch and explain working of pelt on wheel.
15. Explain FRL unit with a neat sketch.
16. Explain the following i) check valve ii) shuttle valve.

[Turn over .....

**PART – C**

17. (a) Explain with a neat sketch the working principle of Bourdon's tube pressure gauge.

(Or)

(b) The pressure of water in a pipe line was measured by means in the open tube is 150mm higher than that of left tube. The height of water in the left tube is 40mm. Determine the static pressure is the pipe in (i) head of water in meters and (ii) KN/m<sup>2</sup>.

18. (a) Derive an expression for the discharge through venturimeter.

(Or)

(b) A pipe 300 m long has a slope of 1 in 100 and tapers from 1.5 m diameter at the higher end and 0.625 m diameter at the lower end. The discharge of water through the pipe is 100 lit/sec. The pressure at the higher end is 110 kN/m<sup>2</sup>. Find the Pressure at the lower end and neglecting the friction.

19. (a) Explain the working of Francis turbine with neat sketch.

(Or)

(b) A single acting reciprocating pump having cylinder, diameter of 150mm and a stroke of 300mm is required to raise water through a height of 20m. The crank rotates at 60rpm and the discharge is 5 liters per second. Find

- i) Theoretical discharge of the pump
- ii) Percentage slips of the pump
- iii) Theoretical power required to drive the pump.
- iv) Compare impulse turbine and reaction turbine.

20. (a) Explain automatic operation of double acting cylinder with a sketch.

(Or)

(b) List out the types of DCV. Explain any three.

21. (a) Draw and explain hydraulic circuit for shaping machine.

(Or)

(b) Explain with neat sketch types fluid power pumps.

## MODEL QUESTION PAPER-II

Term : IV

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks : 75

Course : Fluid Mechanics and Fluid Power

Course Code: N1ME307

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.**

**(2) Answer division (a) or division (b) of each question in PART – C.**

**(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

- 1) Define and classify fluids
- 2) What is meant by pressure head?
- 3) Define wetted perimeter.
- 4) Write down the expression for continuity of flow?
- 5) What is meant by cavitation?
- 6) What is the function of relief valve?
- 7) What is use of hydraulic actuator?
- 8) Write the expression for the impact jet on a moving flat plate in the direction of flow.

### PART – B

- 9) How Manometers are classified?
- 10) Name any three assumptions made in deriving the Bernoulli's equations
- 11) Define hydraulic gradient line and total energy line.
- 12) Mention the different types of casings used in centrifugal pump.
- 13) What is the purpose of priming is used in pump?
- 14) Name any three types of DCV?
- 15) What is the use of Pressure Intensifier?
- 16) Name any three service properties of hydraulic Fluids?

**[ Turn over .....**

**PART – C**

17. (a). i) State and prove Pascal's Law of Transmission.

ii) A gauge records a pressure of 25KN/m<sup>2</sup>. Calculate absolute pressure in KN/m<sup>2</sup>, if atmospheric pressure is 750 mm of mercury.

(Or)

(b). An U-tube differential manometer connects two pressure pipes A and B. The pipe A contains Carbon tetra chloride having a specific gravity of 1.594 under a pressure of 120KN/m<sup>2</sup>. The pipe B contains oil of specific gravity 0.8 under pressure of 220KN/m<sup>2</sup>. The pipe A lies 3m above the pipe B. The centre of the pipe B is at the level of mercury in the limb which connects the pipe A. Find the difference in the levels of mercury.

18. (a) A pipe 300m long has a slope of 1 in 100 tapers from 1.5m diameter at the higher end to 0.625m diameter at the lower end. The discharge of water through the pipe is 1m<sup>3</sup>/s. If the pressure at the higher end is 98.1kpa. Find the pressure at lower end.

(Or)

(b) i) Using Chezy's formula, determine the head lost due to friction in a pipe of 75mm diameter And length of 30m. The velocity of the flow is 1.8m/sec. Take Chezy's constant C=100.

ii) State the difference between Venturimeter and Orifice Meter.

19. (a). Explain the working of Francis turbine with neat sketch.

(Or)

(b). A double acting reciprocating pump has a piston diameter of 150mm and stroke of 300mm. It raises water to height of 18m at a speed of 40 rpm. The discharge is 400 lpm. Calculate (i) Theoretical Discharge (ii) percentage of slip and (iii) Co-efficient of discharge of the pump.

20. (a). Write shorts notes on FRL unit with a neat sketch.

(Or)

(b). Explain the operation of double acting cylinder using metering-out control with the aid of a circuit diagram.

21. (a). Write shorts notes on i) spring loaded type accumulator ii) Radial piston pump

(Or)

(b). Explain the hydraulic circuits of table movement of a Milling machine with a neat sketch.

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME207**

**Term : IV**

**Course Name : ELECTRICAL DRIVES AND CONTROL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Electrical Drives and Control	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topics	Hours
I	DC CIRCUITS AND DC MACHINES	18
II	AC CIRCUITS AND AC MACHINES	18
III	STEPPER AND SERVO MOTORS & DRIVES	18
IV	POWER SUPPLIES AND LOGIC GATES	18
V	CONTROL ELEMENTS AND PLC	18
	<b>TOTAL</b>	<b>90</b>

**Course Outcomes:**

On successful completion of the course, the student will be able to:

<b>C207.1</b>	Explore fundamental of DC electric circuit laws and DC Machines
<b>C207.2</b>	Explore fundamental of AC electric circuit laws and AC Machines.
<b>C207.3</b>	Understand servo motors and stepper motors in electrical drive systems.
<b>C207.4</b>	Analyze the various power supply circuits and Logic gates.
<b>C207.5</b>	Study of various control elements and PLC

**Course Outcome linkage to Cognitive Level:****Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
<b>C207.1</b>	Explore fundamental of DC electric circuit laws and DC Machines	R/U/A	1,4	18
<b>C207.2</b>	Explore fundamental of AC electric circuit laws and AC Machines.	R/U/A	1,4	18
<b>C207.3</b>	Understand servo motors and stepper motors in electrical drive systems.	R/U/A	1,4,5	18
<b>C207.4</b>	Analyze the various power supply circuits and Logic gates.	R/U/A	1,4,5	18
<b>C207.5</b>	Study of various control elements and PLC	R/U/A	1,4,5,7	18
			<b>Total sessions</b>	90

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for			Marks weightage (%)
				R	U	A	
1	DC CIRCUITS AND DC MACHINES	18	25	3	18	4	17.86 %
2	AC CIRCUITS AND AC MACHINES	18	25	3	18	4	17.86 %
3	STEPPER AND SERVO MOTORS &	18	25	3	18	4	17.86 %
4	POWER SUPPLIES AND LOGIC GATES	18	25	3	18	4	17.86 %
5	CONTROL ELEMENTS AND PLC	18	25	3	18	4	17.86 %
I-V			15	6	9		17%
<b>Total</b>			<b>140</b>	<b>21</b>	<b>99</b>	<b>20</b>	<b>100 %</b>

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Electrical Drives and Control	3	-	-	3	3	-	1

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**NIME207 - ELECTRICAL DRIVES AND CONTROL**  
**DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>DC CIRCUITS AND DC MACHINES</b></p> <p>Definition- Electric current, voltage and resistance -Ohm's law and Kirchoff's law. Resistance in series and parallel and series, parallel – simple problems electromagnetism(definitions only ) – magnetic flux, flux density magnetic field intensity, MMF, permeability, reluctance, Faraday's law of electromagnetic induction, electrical and mechanical units</p> <p>DC generators – construction, principle of operation, types and application.</p> <p>DC motors: - construction, principle of operation, types and application.</p> <p>Necessity of starters: Three point, four point starters.</p>	<b>18</b>
<b>II</b>	<p><b>AC CIRCUITS AND AC MACHINES</b></p> <p>Fundamentals of AC voltage, and current – peak, average, RMS value of sine wave, frequency, time period, amplitude, power and power factor (definition only)- star and delta connection relationship between phase, line voltage and current in star and delta connections.</p> <p>Transformer: Principle of operation and construction – EMF equation (no definition)- losses in Transformer – efficiency – application.</p> <p>Alternator construction – principle of operation – types and applications.</p> <p>AC machine: AC motors- Principle of operation of single phase capacitor start induction motor-universal motor applications-Three phase induction motors – Squirrel cage and slip ring Induction motors (construction and working principle only) - application – speed control of 3<math>\Phi</math> Induction motor -Necessity of starters – DOL and star/delta starter.</p>	<b>18</b>
<b>III</b>	<p><b>STEPPER AND SERVO MOTORS &amp; DRIVES:</b></p> <p>PMDC, Stepper motor- construction and working principle and applications - Servo motor – types: brushless servo motor, permanent magnet servo motor construction and applications.</p> <p>Industrial drives- types, group drive, individual drive, multi motor drive, block diagram of Variable frequency drive , stepper motor drive: single stepping and half stepping. Servo drives.</p> <p>Electrical safety: - importance of earthing - electric shock: first aid, precautions - causes of accident and their preventive measures.</p> <p>Energy conservation</p>	<b>18</b>

<b>IV</b>	<p><b>POWER SUPPLIES AND LOGIC GATES</b></p> <p>Diode – terminals: anode and cathode, forward biasing and reverse biasing – use of diode in rectifiers – half wave and full wave – necessity of filters- Regulated power supplies: IC voltage regulators – SMPS, UPS and Inverters – General description and their applications. Display devices – LED, 7 segment LED, LCD</p> <p>Logic gates: Positive and negative logic, definition, symbol truth table, Boolean expression for OR, AND, NOT, NOR, NAND, EXOR AND EXNOR gates – Universal logic Gates: NAND, and NOR.</p>	<b>18</b>
<b>V</b>	<p><b>CONTROL ELEMENTS AND PLC</b></p> <p>Fuses – selection of fuse – necessity of fuse- fuse switch units.</p> <p>Sensors: Photo electric sensor, Inductive proximity sensors, Temperature sensors.</p> <p>Switches: Push button switch, selector switch, limit switch, pressure switch, temperature switch, float switch and reed switch.</p> <p>Relays – NO, NC – usage- bimetallic thermal overload relays.</p> <p>Contactors- usage – necessity of contactor- Solenoid type contactor</p> <p>Circuit breakers – Moulded case Circuit breaker (MCCB) and Miniature Circuit breaker (MCB), Oil Circuit breakers (OCB), Earth leakage circuit breaker (ELCB)</p> <p>Features of PLC-PLC Block diagram- PLC scan - Fixed and modular PLC Ladder logic-NO, NC contacts-Coils-AND, OR.</p>	<b>18</b>

**Text Books:**

- 1) A course in electrical engineering - B.L.Theraja - Multi Colour Edition, S Chand & Co, Reprint 2006
- 2) Control of Machines - S.K Bhattacharya, Brijinder Singh – New Age Publishers, Second Edition- Reprint 2010
- 3) Electronic Circuits & System- Analog and Digital – Y.N.Bapat - Tata Mc Graw Hill.

**Reference Books:**

- 1) Electrical Technology – Hughes - 8th Edition, Pearson Education.
- 2) Electronic Device and Circuits- An introduction – Allen Mottershed - Prentice Hall of India.

## MODEL QUESTION PAPER-I

Term : IV

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks: 75

Course : Electrical Drives and Control

Course Code: N1ME207

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.**

**(2) Answer division (a) or division (b) of each question in PART – C.**

**(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART-A

1. State Ohm's law
2. Define mmf. Give its unit.
3. What is frequency?
4. Write the emf equation of Transformer.
5. Write the applications of Stepper motor.
6. Draw the symbol of LED.
7. List the advantages of PLC.
8. Expand MCCB.

### PART-B

9. What is meant by potential difference and what is its unit?
10. What is meant by flux density?
11. What is average value?
12. State losses in the transformer.
13. Define energy conservation.
14. What is step angle?
15. Draw the symbol of and write its truth table.
16. What is a need of fuse?

**[ Turn over .....**

**PART-C**

17. (a) Explain the construction of DC generator with neat diagram.  
(Or)  
(b) Explain the construction and working of 3 point starter with neat diagram.
18. (a) Explain the principle of operation of single phase transformer  
(Or)  
(b) Explain the working principle of  $3\Phi$  squirrel cage induction motor.
19. (a) Explain the construction and working of PMDC motor.  
(Or)  
(b) Explain the various types of drives.
20. (a) Explain the working of full wave rectifier with a neat diagram Also draw its input and output waveforms.  
(Or)  
(b) Explain SMPS with its block diagram.
21. (a) Explain the photo electric sensor.  
(Or)  
(b) (i) Explain the PLC with its block diagram.  
(ii) Draw ladder logic for OR gate.

## MODEL QUESTION PAPER-II

Term : IV

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks : 75

Course : Electrical Drives and Control

Course Code: N1ME207

**Note:** 1) Answer any Five questions in each PART - A and PART - B.

*Q.No. 8 in PART — A and Q.No. 16 in PART — B is compulsory.*

2) Answer division (a) or division (b) for each question in PART — C.

3) Each question carries 2 marks in PART - A, 3 marks in PART –B and 10 marks in PART — C.

### PART-A

1. Define term voltage.
2. Write EMF equation of Transformer.
3. What is group drive?
4. What is inverter?
5. Draw the symbol of NO and NC.
6. State the necessity of filters in rectifier circuits.
7. Define RMS value.
8. State ohm's law

### PART – B

9. State the losses in transformer.
10. What is reluctance and Permeability?
11. Write the precautions to avoid electric shock.
12. What is forward biasing of diode?
13. What is Positive logic and Negative logic?
14. What is limit switch? Where it is used?
15. State the types of industrial drives.
16. Mention the methods of speed control of three phase induction motors.

**Turn over ....**

**PART – C**

17. a). Explain the constructional details of DC Machine.  
(Or)  
b). Explain the faraday's of electromagnetic induction.  
c). State and Explain the Kirchhoff's laws
18. a). Explain the stator and rotor constructional details of salient pole alternator.  
(Or)  
b). Explain the construction and working of single phase capacitor start induction motor.
19. a). Explain the various industrial drives with neat sketches.  
(Or)  
b). Explain construction and working principle of permanent magnet servo motor,
20. a). Explain full wave rectifier with necessary diagrams.  
(Or)  
b). what is universal gates which gates are used as universal gates and derive the basic gates (AND, OR, NOT) from NAND gate.
21. a). Explain the diagram of PLC and explain each block.  
(Or)  
b). Explain the neat diagram of solenoid type contactor and explain its working.

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VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1ME308**  
**Term : IV**  
**Course Name : STRENGTH OF MATERIALS AND FLUID MECHANICS  
PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Strength of Materials And Fluid Mechanics Practical	4	60	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C308.1</b>	Acquire skills on different types of testing methods of metals.	
<b>C308.2</b>	Conduct material testing on elasticity, hardness, bending, shear strength.	
<b>C308.3</b>	Determine modules of rigidity of open spring and closed coil springs.	
<b>C308.4</b>	Determine the co-efficient of discharge of venture meter, orifice meter, mouth piece and orifice and co-efficient of friction in pipes.	
<b>C308.5</b>	Conduct performance test on centrifugal pump, reciprocating pumps Impulse and Reaction Turbine.	

## Course Outcome linkage to Cognitive Level

Cognitive Level Legend: R- Remember, U- Understand, A- Application

Course Outcome	Linked Expts.	CL	Linked PO, PSO	Teaching Hrs
<b>C308.1</b> Acquire skills on different types of testing methods of metals.	1,3,4	U/A	1,2,3,4	12
<b>C308.2</b> Conduct material testing on elasticity, hardness, bending, shear strength.	2,6	U/A	1,3,7	12
<b>C308.3</b> Determine modules of rigidity of open spring and closed coil springs.	5	U/A	1,2,3,5	12
<b>C308.4</b> Determine the co-efficient of discharge of venturimeter, orifice meter, mouth piece and orifice and co-efficient of friction in pipes.	7,8,9,10	U/A	1,2,3,5	12
<b>C308.5</b> Conduct performance test on centrifugal pump, reciprocating pumps Impulse and Reaction Turbine.	11,12	U/A	1,2,3,7	12

### Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Strength of Materials And Fluid Mechanics Practical	3	3	3	1	2	-	2

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## **Strength of Materials Laboratory**

### **Exercises**

#### **1. Test on Ductile Materials:**

Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.

#### **2. Hardness Test:**

Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.

#### **3. Torsion test:**

Torsion test on mild steel – relation between torque and angle of twist- determination of shear modulus and shear stress.

#### **4. Impact test:**

Finding the resistance of materials to impact loads by Izod test and Charpy test.

#### **5. Tests on springs of circular section:**

Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring)

#### **6. Shear test:**

Single or double shear test on M.S. bar to finding the resistance of material to shear load.

## **Fluid Mechanics Laboratory**

### **Exercises**

1. Verify the Bernoulli's Theorem.
2. Determination of co-efficient of discharge of a mouth piece / orifice by variable head method.
3. Determination of co-efficient of discharge of a venturi meter / orifice meter.
4. Determination of the friction factor in a pipe.
5. Performance test on reciprocating pump / centrifugal pump and to draw the characteristics curves.
6. Performance test on impulse turbine / reaction turbine and to find out the Efficiency.

## LIST OF EQUIPMENTS

1. UTM	01 No.
2. Rockwell's Hardness Testing Machine	01 No.
3. Torsion testing machine	01 No.
4. Impact testing machine	01 No.
5. Spring testing arrangements	01 No.
6. Shear testing machine	01 No.
7. Vernier caliper	02 Nos.
8. The Bernoulli's Apparatus	01 No.
9. An Open tank fitted with a small orifice /an external mouth piece and a collecting tank with Piezometer	01 No.
10. A Centrifugal pump having the discharge line with venturi meter / orifice meter arrangement	01 No.
11. An arrangement to find friction factor of pipe	01 No.
12. A reciprocating pump with an arrangement for collecting data to find out The efficiency and plot the characteristics curve.	01 No.
13. A centrifugal pump with an arrangement for collecting tank to find out The efficiency and plot the characteristics curve.	01 No.
14. A impulse turbine with an arrangement for calculating data to find out the efficiency	01 No.
15. A reaction turbine with an arrangement for collecting data to find out the efficiency	01 No.

## END EXAMINATION

### Note:

- All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot.
- Record note book should be submitted during examination.

### Detailed Allocation of Marks for External Assessment

#### Strength of material lab

<b>Part A</b>	-	<b>35 marks</b>
Observation	-	10
Tabulation / Calculation	-	20
Result / Graph	-	5

#### Fluid mechanics lab

<b>Part B</b>	-	<b>35 marks</b>
Observation	-	10
Tabulation / Calculation	-	20
Result / Graph	-	5
<b>Viva-voce</b>	-	<b>05 marks</b>
<b>Total</b>	-	<b>75 marks</b>

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME309**

**Term : IV**

**Course Name : SPECIAL MACHINES PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks		Total	
Special Machines Practical	4	60	<b>Internal Assessment</b>	<b>End Examination</b>		100
			25	75		

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C309.1</b>	Identify a milling, shaping, slotter, cylindrical grinding, tool & cutter grinding and surface grinding machine and its parts.
<b>C309.2</b>	Perform operations on milling machine & Slotting machine
<b>C309.3</b>	Perform operations on shaping machine & Grinding machine

### Course Outcome linkage to Cognitive Level:

Cognitive Level Legend: R- Remember, U- Understand, A- Application

Course Outcome		Expts Linked	CL	Linked PO,PSO	Teaching Hrs
C309.1	Identify a milling, shaping, slotter, cylindrical grinding, tool & cutter grinding and surface grinding machine and its parts.	1,2,3,4,5,6,7,8,9,10	U/A	PO1,PO4,PO7	12
C309.2	Perform operations on milling machine & Slotting machine	3,4,5,6,7	U/A	PO1,PO4,PO7	24
C309.3	Perform operations on shaping machine & grinding machine	1,2,8,9,10	U/A	PO1,PO4,PO7	24
		<b>Total sessions</b>			60

### Course-PO Attainment Matrix

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
<b>SPECIAL MACHINES PRACTICAL</b>	3	-	-	3	-	-	3

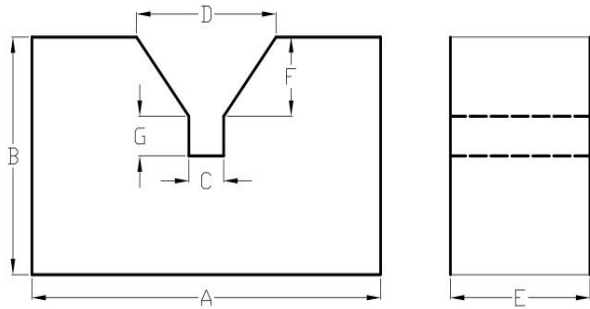
**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

- Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- *If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed*

**LIST OF EXERCISES:**

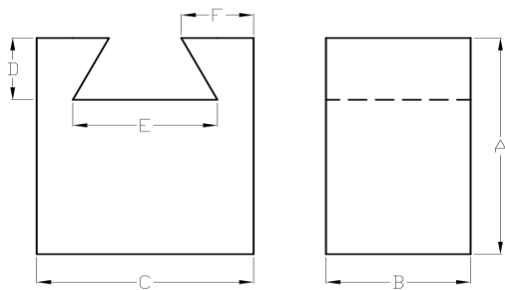
**Raw Material: M.S. / C.I .**

1. Make 'V' Block using shaping machine



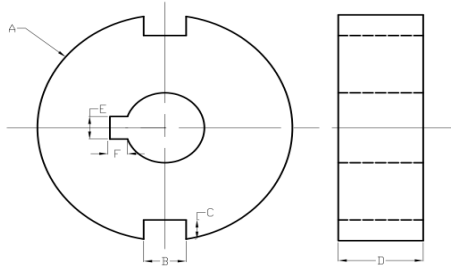
Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Make dovetail using shaping machine



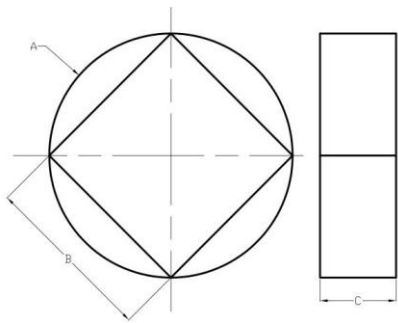
Dimensions			
Sl.No	Part Name	Actual	Obtained

3. Make groove cut using slotting machine



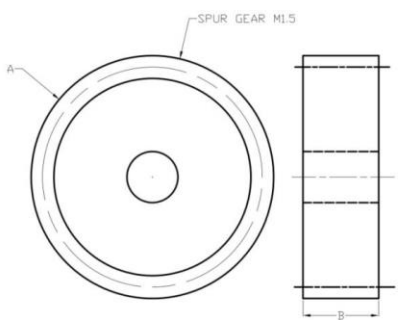
Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Make round to square in milling machine



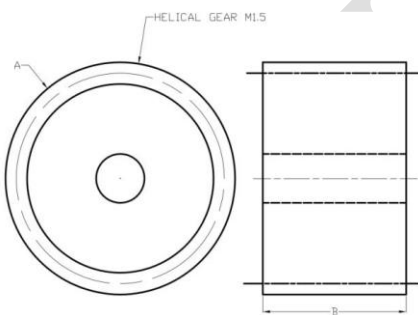
Dimensions			
Sl.No	Part Name	Actual	Obtained

5. Make Spur Gear using milling machine by Differential Indexing



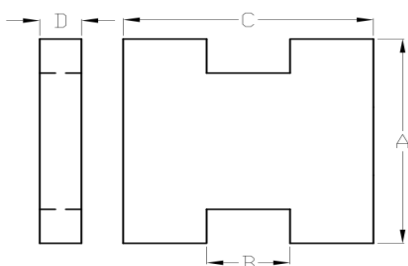
Dimensions			
Sl.No	Part Name	Actual	Obtained

6. Make Helical Gear using milling machine



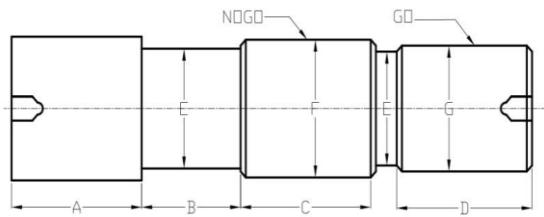
Dimensions			
Sl.No	Part Name	Actual	Obtained

7. Make slot cut using milling machine.



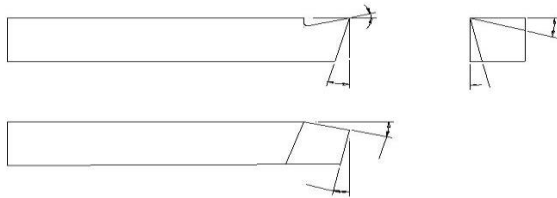
Dimensions			
Sl.No	Part Name	Actual	Obtained

8. Make Progressive type Plug gauge using Cylindrical Grinding machine



Dimensions			
Sl.No	Part Name	Actual	Obtained

9. Make a turning tool using Tool and Cutter Grinder



Dimensions			
Sl.No	Part Name	Actual	Obtained

10. Make plain surfaces (four surfaces) using surface Grinder



Dimensions			
Sl.No	Part Name	Actual	Obtained

**Content beyond syllabus:**

- 🔧 Demonstration on Gear Hobbing Machine.

### LIST OF EQUIPMENTS

Vertical milling machine /		
Vertical attachment	-	2 Nos.
Universal Milling Machine	-	2 Nos.
Surface Grinding Machine	-	1 No.
Cylindrical Grinding Machine	-	1 No.
Tool and Cutter Grinder	-	1 No.
Shaping Machine	-	2 Nos.
Slotting Machine	-	1 No.
Tools and Measuring instruments	-	Sufficient quantity.
Consumables	-	Sufficient quantity

### END EXAMINATION

**Note: All the exercises should be given in the question paper and students are allowed to select by a lot. Record note book must be submitted for the examination.**

### Detailed Allocation of Marks for External Assessment

Job preparation / Marking	-	15
Setting / Operations	-	30
Dimensions / Surface Finish	-	25
Viva voce	-	5
<b>Total</b>	-	<b>75</b>

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1ME208**  
**Term : IV**  
**Course Name : ELECTRICAL DRIVES AND CONTROL PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATIONS:**

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			Duration
	Hours/ Week	Hours/ Semester	Marks			
Electrical Drives and Control Practical	4	60	<b>Internal Assessment</b>	<b>Board Examination</b>	<b>Total</b>	3 Hrs
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

C.208.1	Explore fundamental of DC electric circuit laws and DC Machines.
C.208.2	Explore fundamental of AC electric circuit laws and AC Machines.
C.208.3	Understand servo motors and stepper motors in electrical drive systems.
C.208.4	Analyze the various power supply circuits and Logic gates.
C.208.5	Study of various control elements and PLC

### Course Outcome linkage to Cognitive Level:

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO,PSO	Teaching Hrs
C.208.1	Explore fundamental of DC electric circuit laws and DC	1,2,3	U/A	1,4,	12
C.208.2	Explore fundamental of AC electric circuit laws and AC Machines.	4,5,6	U/A	1,4,	12
C.208.3	Understand servo motors and stepper motors in electrical drive systems.	7,8,9	U/A	1,4,5	12
C.208.4	Analyze the various power supply circuits and Logic	10,11,12	U/A	1,4,5,7	12
C.208.5	Study of various control elements and PLC	13,14,15	U/A	1,4,5,7	12

### Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Electrical Drives and Control Practical	3	-	-	3	3	-	2

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## **LIST OF EXPERIMENTS**

1. Verification of Ohm's Law
2. Testing of DC starters – 3 point and 4 point starter
3. Load test on DC shunt motor
4. Testing of AC starters - DOL , star - Delta starter
5. Load test on single phase induction motor
6. Load test on three phase squirrel cage motor
7. Testing of relays, contactors, push buttons and limit switch
8. Connection and Testing of MCB, ELCB
9. Construction and testing of half wave and Full wave rectifier.
10. Construction and testing of IC voltage regulator using IC 7805.
11. Verification of truth tables for logic gates.
12. Verification of universal gates.
13. Identification and testing of display devices- LED, 7 segment LED, Laser diode.
14. Testing of Stepper motor drive.
15. Testing of Servo motor drive.

## LIST OF EQUIPMENTS

### *Electrical Lab*

1. DC ammeter 0-5A	-	1No.
2. DC ammeter 0-25A	-	1 No.
3. DC voltmeter 0-30V	-	1 No.
4. DC voltmeter 0-300V	-	1 No.
5. Rheostat 10.8 ,8.5A	-	1 No.
6. AC ammeter 0-5A	-	1 No.
7. AC ammeter 0-10A	-	2 Nos.
8. AC voltmeter 0-50V	-	3 Nos.
9. AC wattmeter 5A-10A (0-750W,0-600V)	-	3 Nos.
10. Loading rheostat 5A,230V	-	1 No.
11. Tachometer 0-1000rpm (Analog type)	-	1 No.
12. Variac 20A,250V (Auto transformer )	-	2 Nos.
13. 3 point starter 20A,220V	-	1 No.
14. DOL starter 16A,415V	-	1 No.
15. Star /Delta starter 20a,600V	-	1 No.
16. Over load relay 1 to 2.5A	-	1 No.
17. Air break contactors 20A,220V	-	4 Nos.
18. Push button 2A ,220V	-	2 Nos.
19. Limit switch 20A,220V	-	1 No.
20. MCB 20A single pole	-	1 No.
21. MCB 20A double pole	-	1 No.
22. ELCB 2pole 20A,100mA	-	1 No.
23. ELCB 4POLE 20A,100mA	-	1 No.

## END EXAMINATION

**Note: All the exercises are to be completed. Any one exercise from Part A or Part B should be given for the Examination.**

### Detailed allocation of Marks for External assessment

Circuit diagram	-	10
Connections & Readings	-	30
Calculations & Graph	-	30
Viva Voce	-	5
<b>TOTAL</b>	-	<b>75</b>

**VIRUDHUNAGAR S.VELLAICHAMY NADAR POLYTECHNIC COLLEGE  
(AUTONOMOUS)**

(Affiliated to Directorate of Technical Education, Chennai-25)

VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME310**

**Term : V**

**Course Name : DESIGN OF MACHINE ELEMENTS**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks		Total	
Design of Machine Elements	6	90	Internal Assessment	End Examination		100
			25	75		

**Topics and Allocation of Hours:**

Unit	Topics	Hours
I	Design of Joints And Fasteners	18
II	Design of shafts, couplings and keys	18
III	Design of friction drives (flat belt and v-belt)	18
IV	Design of bearings	18
V	Design of levers and spur gears	18
	<b>TOTAL</b>	<b>90</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

C.310.1	Acquire knowledge on engineering materials, and design Joints and fasteners.
C.310.2	Able to Design shafts, keys and couplings required for power transmission.
C.310.3	Acquire knowledge to Design flat and V – belt for power transmission.
C.310.4	Acquire knowledge on various types of bearings and their applications.
C.310.5	Able to Design spur gear used for power transmission.

**Course Outcome linkage to Cognitive Level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO	Teaching Hrs
C.310.1	Acquire knowledge on engineering materials, and design Joints and fasteners.	A	1,2,3,7	18
C.310.2	Able to Design shafts, keys and couplings required for power transmission.	A	1,2,3,7	18
C.310.3	Acquire knowledge to Design flat and V – belt for power transmission.	A	1,2,3,7	18
C.310.4	Acquire knowledge on various types of bearings and their applications.	A	1,2,3,7	18
C.310.5	Able to Design of spur gear used for power transmission.	A	1,2,3,7	18
			<b>Total sessions</b>	90

## Course Content and Blue Print of Marks for End Examination:

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for			Marks weightage (%)
				R	U	A	
1	ENGINEERING MATERIALS, JOINTS AND FASTENERS	18	30	-	-	30	20
2	DESIGN OF SHAFTS, KEYS AND COUPLINGS	18	30	-	-	30	20
3	DESIGN OF FLAT BELTS AND V-BELTS	18	30	-	-	30	20
4	DESIGN OF BEARINGS	18	30	-	-	30	20
5	DESIGN OF LEVERS AND SPUR GEARS	18	30	-	-	30	20
	<b>Total</b>	90	150	-	-	150	100

## Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
<b>DESIGN OF MACHINE ELEMENTS</b>	3	3	3	-	-	-	3

*Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.*

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

*If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3*

*If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2*

*If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1*

*If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.*

**N1ME310 - DESIGN OF MACHINE ELEMENTS**  
**DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>ENGINEERING MATERIALS, JOINTS AND FASTENERS</b> General Considerations in Machine Design. Engineering materials - Factors affecting selection of material – BIS designation of Ferrous materials – Preferred number - Factor of safety and allowable stress – Stresses: Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion - problem. Creep strain and Creep Curve- Fatigue, S-N curve, Endurance Limit -Stress Concentration – Causes &amp; Remedies. Theories of Elastic Failures – Principal normal stress theory, Maximum shear stress theory &amp; maximum distortion energy theory. <b>Joints:</b> Design of sleeve and cotter joint, knuckle joint and welded joint. <b>Fasteners:</b> Design of bolted joints - eye bolts.</p>	18
<b>II</b>	<p><b>DESIGN OF SHAFTS, KEYS AND COUPLINGS</b> <b>Shafts:</b> Design of shafts subjected to – twisting moment – bending moment – combined twisting and bending moments – fluctuating loads – design of shafts based on rigidity. <b>Keys:</b> Types of keys - design of sunk keys only - Effect of keyways on shaft-problems. <b>Couplings:</b> Requirements of good couplings – types - design of - rigid protected type flange couplings - marine couplings – pin type flexible coupling (Description only).</p>	18
<b>III</b>	<p><b>DESIGN OF FLAT BELTS AND V-BELTS</b> <b>Flat Belts:</b> Types of belts - materials for belt – types of belt drives – Speed ratio – effect of slip - length of flat belts –Tension Ratio <math>T_1/T_2=e^{\mu\theta}</math> - centrifugal tension - power transmitted – condition for maximum power - transmission – Initial Tension - problems - design procedure of flat belts - design of flat belt based on manufacturer’s data only – problems. <b>V-Belts:</b> V-belt drive - comparison with flat belt drive - designation of V-belts – length of belt - power transmitted – Design of V-belt using manufacturer’s data only – Problem.</p>	18
<b>IV</b>	<p><b>DESIGN OF BEARINGS</b> <b>Bearings:</b> Classifications of bearings – sliding contact and rolling contact bearings - radial and thrust bearings - roller bearing – types -Designation of ball bearings - materials used for bearings - journal bearings - heat generated - heat dissipated - cooling oil requirement – problems - design of journal bearings – Problems. Design based on approved data books only.</p>	18
<b>V</b>	<p><b>DESIGN OF LEVERS AND SPUR GEARS</b> <b>Levers:</b> Types of levers – applications - mechanical advantage – leverage - displacement ratio - design of-hand lever-foot lever-cranked lever - problems. <b>Spur gears:</b> Gear drives - merits and demerits over belt drive – Classification of gears - gear materials - spur gear terminology -design of spur gears based on Lewis &amp; Buckingham equation -Problems – speed reducer – types –(Approved data books only).</p>	18

**Text Books:**

- 1) Machine Design, Pandya & Shah, Edn. 1995, Charotar Publishing House.
- 2) Machine Design, T. V. Sundararamoorthy & N. Shanmugam, Revised Edition June-2003–Anuradha Publications, Kumbakonam.
- 3) Design Data Book – by PSG College of Technology, DPV Printers, Coimbatore.

**Reference Books:**

- 1) A text book of Machine Design, R.S. Khurmi & J.K.Gupta, Edn. 18, Euroasia Publishing House Pvt. Limited, New Delhi-110 055.
- 2) Machine Design Bandari,
- 3) Theory and Problems of Machine Design, Holowenko, Laughlin, Schaum's outline Series.

**Question Pattern for Design of machine elements in Mechanical Engineering:****Course Code: N1ME310****Course Name: Design of Machine Elements****a) Question Paper Pattern for Periodical (Test – I & Test – II)****With No Choice**

<b>Part – A</b>	1 Questions x 5 marks	-----	5 marks
<b>Part – B</b>	3 Questions x 15 marks	-----	45 marks
			-----
Total			----- 50 marks
			-----

**b) Question Paper Pattern for Model Exam:**

<b>Part – A</b>	5 Questions in (either 'or' pattern)	5 x 15 marks	----- 75 marks
			-----
Total			----- 75 marks
			-----

- These questions may have sub division also.
- (P.S.G Design Data book is permitted.( Required abstract pages of the P.S.G. Design Data Book certified by the Chief Superintendent may be permitted )

## MODEL QUESTION PAPER -I

Term : V Time : 3Hrs  
Programme : Diploma in Mechanical Engineering Max. Marks: 75  
Course : Design of Machine Elements Code : N1ME310

**NB: (i) Answer All questions and choosing either division (a) or division (b) of each question**

**(ii) Each questions carry 15 marks.**

**(iii) PSG DESIGN DATA BOOK (Or) Abstract of PSG Design DATA BOOK is permitted.**

1. (a) (i) Name the type of steel with their composition designated as **XT72W18Cr4V1**

(ii) A steam engine cylinder has an effective diameter of 350mm and the maximum steam pressure acting on the cylinder cover is  $1.2 \text{ N/mm}^2$ . Calculate the number and size of bolts to secure the cylinder cover. Assume permissible stress is  $35 \text{ N/mm}^2$ .

(Or)

(b) Design a sleeve & cotter joint to withstand a tensile load of 60kN. The rods, sleeve and cotter are made of same materials and the permissible stresses are given below:  $60\text{N/mm}^2$  in tension,  $125\text{N/mm}^2$  in compression and  $70\text{N/mm}^2$  in shear.

2. (a) A shaft transmits 25kW at 1500 rpm. It is also subjected to a bending moment of magnitude 100Nm due to a pulley. The material used is 30C8 steel with yield stress 300 MPa. Find the diameter of the shaft. Take FOS = 3. The shock and fatigue factors are  $K_b = 1.5$  for bending and  $K_t = 1.2$  for tension.

(Or)

(b) Design a Protective type flange coupling to connect two shafts to transmit 7.5kW at 720 rpm. The permissible shear stresses for the shaft, bolts and, key materials are  $33 \text{ N/mm}^2$ . Permissible crushing stress for keys and bolts and  $60 \text{ N/mm}^2$  and permissible shear stress for cast iron is  $15 \text{ N/mm}^2$ .

3. (a) Design a belt drive to transmit 22.5 KW at 740 rpm to an aluminum rolling machine. The speed ratio is 3. The distance between the pulleys is 3m. Diameter of the rolling machine pulley is 1.2m

(Or)

(b) Design a V-belt drive using manufacturer's data to the following specifications.

Power to be transmitted = 75 KW

Speed of the driving pulley = 1440 rpm

Speed of the driven pulley = 400 rpm

Diameter of the driving pulley = 300 mm

Centre distance = 2500 mm,

Service = 16 hrs/day.

**[Turn over .....**

4. (a) (i) What is Bearing? How Bearings are classified?

(ii) A Journal bearing 300mm long 150mm diameter carries a radial load of 9 KN at 1200 rpm. The power lost in friction is 6 KW. Viscosity of oil at room temperature is 0.018 N-s/m<sup>2</sup>. Find the Diametral clearance.

(Or)

(b) Design a suitable journal bearing for a centrifugal pump from the following data:

Load of the bearing = 13.25 KN.

Diameter of the journal = 80mm. Speed = 1440 rpm.

Bearing characteristic number =  $30 \times 10^{-6}$

Permissible bearing pressure = 0.7 to 1.4 N/mm<sup>2</sup>.

Average atmospheric temperature = 30°C.

Calculate the cooling requirements using Lasche's equation. Use Mckee's equation for calculating the co-efficient of friction. Assume L/D = 2.

5. (a) (i) Mention the application of levers

(ii) A foot lever is 1m from the centre of the shaft to the point of application of 75 N/mm<sup>2</sup> and allowable shear stress is 70 N/mm<sup>2</sup>. Determine:

1. Diameter of shaft,

2. Dimension of boss,

3. Dimension of shaft at the centre of the bearing,

4. Dimension of Key,

5. Dimension of rectangular arm of the foot lever at 60mm from the centre of the shaft, assuming  $b = 3t$ .

(Or)

(b) A gear drive is required to transmit a maximum power of 25kW. The velocity is 1:2 and the pinion speed is 200 rpm. The approximate centre distance between the shafts may be taken as 600mm. The teeth have 20° stub involute profiles. The material used in gear is Cast Iron. Find the module, face width and number of teeth on each gear. Also check your design for dynamic and wear loads.

## MODEL QUESTION PAPER – II

Term	: V	Time	: 3Hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Design of Machine Elements	Code	: N1ME310

***NB: (i) Answer All questions and choosing either division (a) or division (b) of each question***

***(ii) Each questions carry 15 marks.***

***(iii) PSG DESIGN DATA BOOK (Or) Abstract of PSG Design DATA BOOK is permitted.***

1. a) (i) Define Factor of safety for ductile and Brittle material. (5)  
(ii) A steel bar of 55mm diameter & 180mm long is welded perpendicular to a solid plate by fillet weld around the circumference of the bar. the bar is loaded with 5kN at free end. Determine the size of the weld, if allowable stress in the weld is 90 N/mm<sup>2</sup>. (10)
- (Or)*
- b) Design a Knuckle joint to sustain a maximum pull of 140kN. The following permissible stresses: 75MPa in tensile and 140MPa in compression and 65MPa in shear. (15)
2. a) (i) A solid circular shaft is subjected to a bending moment of  $30 \times 10^5$  Nmm and a torque of  $100 \times 10^5$  Nmm. The shaft material has an ultimate tensile stress of 700 N/mm<sup>2</sup> and ultimate shear stress of 500 N/mm<sup>2</sup>. The factor of safety is 6. Determine the diameter of the shaft. (10)
- (ii) A solid shaft is transmitting 1 MW at 240 r.p.m Determine the diameter of the shaft if the maximum torque exceeds the mean torque by 20%. The maximum allowable shear stress is 60 N/mm<sup>2</sup> (5)
- (Or)*
- b). Design a flanged coupling with 4 bolts to transmit 15kW at 500 rpm with the safe working stresses of 60 N/mm<sup>2</sup> in shear for the shafts, keys and bolts. 120 N/mm<sup>2</sup> in crushing for keys and bolts and 20 N/mm<sup>2</sup> in shear for flange material. (15)
3. a) Design a flat open belt drive to transmit 16 KW at 1200 rpm. The speed ratio is 3. And the centre distance between the pulleys is 1.2m . Assume the steady and fabric high speed duck belt having 6 numbers of plies. Diameter of the driving pulley = 400mm. (15)

*(Or)*

**[Turn over .....**

b) Design a V-belt drive using manufacturer's data to the following specifications.

Power to be transmitted	= 10 KW	
Speed of the driving pulley	= 1200 rpm	
Speed of the driven pulley	= 400 rpm	
Diameter of the driving pulley	= 200 mm	
Diameter of the driven pulley	= 600 mm	
Centre distance	= 1000 mm, (approx)	
Service	= 16 hrs/day and heavy duty	(15)

4. a (i) Explain how ball bearing is designated with an example. (5)

ii) A 150mm diameter shaft supporting a load of 10kN has a speed of 1500rpm. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diameter clearance of the bearing is 0.15mm and the absolute viscosity of the oil at the operating temperature is 0.011kg/m-s. Find the power wasted in friction. (10)

(Or)

b) Design a suitable journal bearing for a centrifugal pump from the following data:

Load of the bearing = 14 KN.

Diameter of the journal = 80mm. Speed = 1440 rpm.

Bearing characteristic number =  $30 \times 10^{-6}$

Permissible bearing pressure = 0.7 to 1.4 N/mm<sup>2</sup>.

Average atmospheric temperature = 30°C.

Calculate the cooling requirements using Lasche's equation. Use Mckee's equation for calculating the co-efficient of friction. Assume L/D = 2. Average temperature of oil ( $t_o$ ) = 60°C.

Temperature rise ( $\Delta t_o$ ) = 10°C. (15)

5. a. (i) Mention the different types of levers and their application. (5)

ii) A cranked lever has the following dimensions:

Length of the handle = 400 mm,

Length of the lever arm = 500mm,

Overhang of the journal = 200mm,

The lever is operated by a single person exerting a maximum force of 400N at a distance of 1/3<sup>rd</sup> the length of the handle from its free end. The permissible bending stress for the lever is 50 N/mm<sup>2</sup> and the shear stress for the shaft is 42 N/mm<sup>2</sup>. Find:

1. Diameter of the handle
2. Cross-section of lever arm and
3. Diameter of the journal. (10)

(Or)

b) Design a spur gear drive to connect an electric motor to a reciprocating pump both being mounted on the same bed. Speed of the motor is 1440 rpm. Speed reduction is 10:1. Motor power is 36.8 kW. The gear are to have 20° pressure angles. The minimum number of teeth on the pinion is 24.

(15)

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME311**

**Term : V**

**Course Name : THERMAL AND AUTOMOBILE ENGINEERING**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Thermal and Automobile Engineering	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

Unit	Topics	Hours
I	THERMAL POWER PLANT, STEAM TURBINES & CONDENSERS, REFRIGERATION AND AIR CONDITIONING	18
II	IC ENGINES AND ITS COMPONENTS	18
III	AUTOMOBILE COOLING SYSTEMS, LUBRICATION SYSTEM & FUEL FEED SYSTEMS	18
IV	AUTOMOBILE TRANSMISSION AND POWER TRAINS & CHASSIS	18
V	AUTOMOBILE BRAKE SYSTEM, ELECTRICAL EQUIPMENT AND POLLUTION CONTROL	18
	<b>TOTAL</b>	<b>90</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

C311.1	Able to explain working of steam turbine and condensers. Appreciate the application of refrigeration and air-conditioning.
C311.2	Able to explain about the constructional details of an Automobile engine parts and performance of IC engine
C311.3	Able to explain about the constructional details and working of cooling and lubrication system of an Automobile engine and Able to describe fuel feed systems for petrol and diesel engines with all devices involved in it.
C311.4	Able to explain the construction and functional features of the power transmission systems and power trains. Understand the different types of chassis and their functions.
C311.5	Able to explain about the constructional details and working of braking system in vehicles. Familiarize electrical and electronics equipments used in automobile & pollution control, techniques.

**Course Outcome linkage to Cognitive Level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
C311.1	Able to explain working of steam turbine and condensers. Appreciate the application of refrigeration and air-conditioning.	R/U/A	PO1, PO2,	18
C311.2	Able to explain about the constructional details of an Automobile engine parts and performance of IC engine	R/U/A	PO1, PO2, PO4	18
C311.3	Able to explain about the constructional details and working of cooling and lubrication system of an Automobile engine and Able to describe fuel feed systems for petrol and diesel engines with all devices involved in it.	R/U/A	PO1, PO2,	18
C311.4	Able to explain the construction and functional features of the power transmission systems and power trains. Understand the different types of chassis and their functions.	R/U/A	PO1, PO2,	18
C311.5	Able to explain about the constructional details and working of braking system in vehicles. Familiarize electrical and electronics equipments used in automobile & pollution control, techniques.	R/U/A	PO1, PO2,PO5	18
		<b>Total sessions</b>		90

### Course Content and Blue Print of Marks for End Examination:

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	Thermal power plant, steam turbines & condensers, refrigeration and air conditioning	18	25	2	18	5	17.86
II	IC engines and its components	18	25	2	18	5	17.86
III	Automobile cooling systems, lubrication system & fuel feed systems	18	25	2	18	5	17.86
IV	Automobile transmission and power trains & chassis	18	25	2	18	5	17.86
V	Automobile brake system, electrical equipment and pollution control	18	25	2	18	5	17.86
I to V*			15	6	9	0	10.70
	<b>Total</b>	90	<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100</b>

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

### Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Thermal and Automobile Engineering	3	3		1	1		

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

# NIME311 – THERMAL AND AUTOMOBILE ENGINEERING

## DETAILED SYLLABUS

### Contents: Theory

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>THERMAL POWER PLANT, STEAM TURBINES &amp; CONDENSERS, REFRIGERATION AND AIR CONDITIONING</b></p> <p>Layout of thermal power plant - merits and demerits of thermal power plant – pollutants - effects and control – cyclone separator – wet scrubber – electrostatic precipitator – control of NO<sub>2</sub> and SO<sub>2</sub>. - fluidised bed combustion. Basic steam power cycles – Carnot, Rankine and modified Rankine cycles – classification of steam turbine - Impulse and reaction turbines - Difference – necessity of compounding – Methods of compounding. Steam condensers – elements of condensing plant – classification of condensers – jet condenser – surface condensers – Comparison of jet and surface condensers – sources of air in condenser – condenser vacuum – vacuum efficiency – condenser efficiency - mass of cooling water required – mass of air present – number of tubes – simple problems. Refrigeration – Definition – COP – Unit of refrigeration - Vapour Compression system – Absorption system – Refrigerant – properties. Air-conditioning – Definition – Centralised air conditioning.</p>	<b>18</b>
<b>II</b>	<p><b>IC ENGINES AND ITS COMPONENTS</b></p> <p>Internal combustion engines - Classifications of I.C Engines – four stroke cycle petrol and diesel engines – two stroke cycle petrol and diesel engines - comparison of four stroke and two stroke engines. Basic Engine Components:– Functions, types, materials and construction of – Cylinder block – Crankcase – Cylinder head – cylinder liners – Comparison of liners – Piston – piston rings – types of compression rings and oil control rings – piston pin – Connecting rod - Crankshaft – flywheel – Cam shaft –Valve and Valve mechanism – Types. Performance of IC Engines: Thermodynamic and commercial tests – indicated power – brake power – friction power – efficiencies of I.C. engines – indicated thermal, brake thermal, mechanical and relative efficiencies – Specific fuel consumption – Morse test – procedure – heat balance sheet – simple problems.</p>	<b>18</b>
<b>III</b>	<p><b>AUTOMOBILE COOLING SYSTEMS, LUBRICATION SYSTEM &amp; FUEL FEED SYSTEMS</b></p> <p>Cooling systems – purpose – types – air and water cooling systems – thermo siphon system - pump assisted water cooling systems – merits and demerits – troubles in cooling system. Lubrication systems – purpose – types of lubricants – additives – Service rating of oil – types of lubricating systems - Full pressure system – oil pumps - oil filters – full flow and bypass filter systems - Troubles in lubrication system – causes and remedies. Fuel Feed Systems: Layout of fuel feed system of petrol engine – types of fuel feed systems – A.C. Mechanical fuel pump – S.U. Electrical fuel pump – fuel filter – Air cleaners - types – Carburetion – Classification of Carburetors – Simple carburetor – Solex Carburetor - Construction and operation – petrol injection – merits and demerits – DTSI – VTI – CCVTI – PGMFI – MPFI system description only.</p>	<b>18</b>

<p><b>IV</b></p>	<p><b>AUTOMOBILE TRANSMISSION AND POWER TRAINS &amp; CHASSIS</b></p> <p><b>Transmission And Power Trains:</b> General arrangement of power transmission system – front engine rear drive – rear engine rear drive – front engine front drive - four wheel drive – applications – clutch – function – components – Types - Single plate , multi plate and diaphragm spring clutch – fluid coupling – Clutch troubles and their causes. Gear box – purpose – types of gear boxes – sliding mesh, constant mesh and synchromesh – floor shift gear changer – gear box troubles and their causes. Drive line – propeller shaft – Universal joint – Cross type only – slip joint – final drive – function – types of gear arrangement – Hotch kiss drive – Torque tube drive – radius rod. Differential – purpose – Construction and operation – Self locking and non slip differential – Differential troubles and their Causes – Semi floating, three quarter floating and full floating rear axles.</p> <p><b>Automobile Chassis:</b> Front axle – Stub axle – Types – Steering system – Ackermann Principle of Steering – Wheel alignment – Factors – Camber , Caster , King pin inclination , Toe in and Toe out on turns - Steering linkages – Steering gears – Cam and double roller , recirculating ball type , Rack and Pinion – Steering troubles and causes – power steering – Necessity – types – Layout of any one type – Collapsible Steering system. Suspension system – Functions – Leaf , coil and Torsion bar – Front suspension systems – independent front suspension – merits and demerits – types – rear end suspension – Air suspension - shock absorber – purpose – telescopic type construction and working.</p>	<p><b>18</b></p>
<p><b>V</b></p>	<p><b>AUTOMOBILE BRAKE SYSTEM, ELECTRICAL EQUIPMENT AND POLLUTION CONTROL</b></p> <p>Brake system – functions – classification of brakes – drum brakes – leading shoe and trailing shoe – Self energizing action – hydraulic brake – brake bleeding - Air assisted hydraulic brakes – Air brake – layout – disc brakes – construction and working – brake troubles and their causes – anti lock brake system. Wheels – types of wheels. Battery – lead acid battery – Nickel alkaline battery – construction – battery rating – charging - testing – starting circuit - construction and operation of starter motor – starting motor drives – over running clutch and Bendix drive – construction and operation – solenoid switch - Charging circuit – alternator construction and operation – regulators – Dynamo. Ignition system – Types – battery coil ignition system –High tension magneto – electronic ignition – Ignition system troubles and remedies. Lighting system – circuit – Head light – Aiming and adjustment – sealed beam head lights – directional signal circuits – fluorescent lamp - Horn circuits – Wind screen wiper. Pollution – Pollutants – source of pollutants – pollution control techniques for petrol and diesel engines emissions – controlling crank case emission (PCV) – controlling evaporative emission (VRS , VSS , VVR , ECS and EEC) – Treatment of exhaust gas (Catalytic converter , EGR) – introduction to automobile electronics- radio interference – suppressors – audio, video systems.</p>	<p><b>18</b></p>

**Text Books:**

1. Thermal Engg, R.K . Rajput , ,8th Edition, Laxmi publications Pvt Ltd , New Delhi.
2. Applied Thermodynamics ,P.K. Nag, ,2nd Edition, TATA Mcgraw - Hill Publishing Co, New Delhi .
3. Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition,S.Chand & Co,NewDelhi
4. Automobile engineering vol- 1, vol – 2, Kirpal singh, Standard publishers distributors New Delhi.
5. Automobile Engineering, G.B.S.Narang, Khanna Publishers, New Delhi.
6. Automotive Mechanics, William H.crouse and Donald .L. Anglin, Tata Mc Graw – Hill Publishing Company Ltd, New Delhi.
7. The Automobile, Harbans Singh Reyat, S.Chand & Co Ltd, New Delhi

**Reference Books:**

1. Thermal Engineering ,P.L Ballaney , 24th Edition ,Khanna Publishers,New Delhi.
2. Thermal Engineering ,B.K. Sarkar , 3rd Edition , Dhanpat Rai & Sons New Delhi.
3. Applied Thermodynamics, Domkundwar and C.PKothandaraman, 2nd Edition, Khanna publishers, New Delhi.
4. Vehicle and Engine technology. Vol. I,Heinz Heisler, ELBS.
5. Automotive Mechanics,Joseph Heitner, East –west Press (P) Ltd, New Delhi.
6. Internal Combustion engines, M.L.Mathur & R.P.Sharma, Dhanpat Rai & Sons.

## **MODEL QUESTION PAPER -I**

Term	: V	TIME	: 3 Hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Thermal and Automobile Engineering	Code	: N1ME311

- [ N.B.: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C.  
(4) Steam tables and Mollier diagram are permitted]**

### **PART – A**

1. State two merits and two demerits of thermal power plant.
2. State the function of a steam condenser.
3. What is the function of a flywheel?
4. Define mechanical efficiency.
5. State the purpose of Lubrication system.
6. Name the components of a clutch.
7. Write the function of a Dynamo.
8. What are the types of ignition system?

### **PART – B**

9. State the necessity for compounding and types of compounding of steam turbines.
10. Give the purpose of different types of piston rings.
11. Write down the basic components of IC engine.
12. What is meant by Morse test?
13. Sketch the air cooling system and name its parts.
14. Describe the working of air suspension system.
15. State any two troubles in ignition system and remedies for them.
16. List the important components of lighting system of an automobile.

**[Turn over .....**

## PART – C

17. (a) A surface condenser condenses 17600 kg of steam per hour. The steam pressure is 0.2 bar and its quality is 0.88. Cooling water enters at 40° C and Leaves at 50° C. The condenser is made of 23 mm diameter tubes. If the velocity of cooling water in the tube is 1.8 m/sec. calculate the number of tubes used in the condenser. The temperature of condensate is 60°C.
- (Or)
- (b) Explain the working of vapour compression system of refrigeration with neat sketch.
18. (a) Explain the working of a four stroke cycle petrol engine with simple sketches.
- (Or)
- (b) A six cylinder SI engine works on 4 stroke cycle. The bore of each cylinder is 70mm and the stroke 100 mm. The clearance volume is 67cc. At the speed of 3300rpm, the fuel consumption is 18.5 kg/hr and the torque developed is 135 Nm. Calculate brake thermal efficiency. If the calorific value of the fuel is 45000 kJ/kg. Take  $\gamma = 1.4$  for air.
19. (a) (i) Explain with a simple sketch the working of a pump assisted water cooling system.  
(ii) Draw the Layout of a fuel feed system of a petrol engine and Lists the salient parts.
- (Or)
- (b) (i) Explain the working of AC mechanical fuel pump with a sketch.  
(ii) Write short note on MPFI system.
20. (a) Explain the working of a multi plate clutch with neat sketch.
- (Or)
- (b) Explain with a neat sketch the construction and operation of a constant mesh gear box.
21. (a) Explain the working of an air braking system.
- (Or)
- (b) Explain the working of a battery coil ignition system.

## MODEL QUESTION PAPER -II

Term	: V	TIME	: 3 Hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Thermal and Automobile Engineering	Code	: N1ME311

- [ **N.B.** (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.
- (2) Answer division (a) or division (b) of each question in PART – C.
- (3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B and 10 Marks in PART – C.
- (4) Steam tables and Mollier diagram are permitted]

### PART – A

1. Write some pollutants from thermal power plant.
2. Define COP of refrigeration.
3. What is the function of a cam shaft?
4. Define indicated power.
5. State the troubles in Lubrication system.
6. What is the purpose of a differential?
7. What are the types of wheels?
8. What are the advantages of four wheel drives?

### PART – B

9. Write the differences between jet condenser and surface condenser.
10. Write the procedure for conducting the Morse test.
11. Compare the four stroke and two stroke engines.
12. What is the function of carburetor? Mention its types.
13. Write short notes on MPFI system.
14. Describe briefly the working of Hotch kiss drive.
15. What is meant by Toe in and Toe out.
16. Write short notes about anti lock brake system.

[Turn over .....

## PART – C

17. (a) Draw the layout of thermal power plant. Mention the merits and demerits of thermal power plant.

*(Or)*

- (b) Explain the working of vapour absorption system of refrigeration with neat sketch.

18. (a) Explain the working of a Two stroke cycle petrol engine with simple sketches.

*(Or)*

- (b) The following results were obtained during a Morse test on a four stroke petrol engines

BP with all cylinders working = 11.92KW, BP with cylinder 1 Cut out = 8.46KW,

BP with cylinder 2 Cut out = 8.60KW, BP with cylinder 3 Cut out = 8.54KW,

BP with cylinder 4 Cut out = 8.50KW, Calorific value of fuel is 42, 000KJ/ Kg.

Calculate the mechanical Efficiency of the engine. If the fuel consumption is 3.5 kg/hour, find the indicated thermal efficiency.

19. (a) Explain with a sketch the working of a full pressure lubricating system.

*(Or)*

- (b) (i) Explain the working of S.U. Electrical fuel pump with a sketch.

(ii) Write short note on PGMFI system.

20. (a) Explain the working of a multi plate clutch with neat sketch.

*(Or)*

- (b) Explain with a neat sketch the construction and operation of a sliding mesh gear box.

21. (a) Explain the working of a hydraulic braking system.

*(Or)*

- (b) Explain the working of a high tension magneto ignition system.

**VIRUDHUNAGAR S.VELLAICHAMY NADAR POLYTECHNIC COLLEGE  
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VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME312**

**Term : V**

**Course Name : PROCESS PLANNING AND COST ESTIMATION**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Process Planning and Cost Estimation	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

Unit	Topics	Hours
I	PROCESS PLANNING	18
II	PROCESS SELECTION	18
III	WORK STUDY	18
IV	COST ESTIMATION	18
V	MACHINING TIME CALCULATIONS	18
	<b>TOTAL</b>	<b>90</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

C312.1	Understand process planning concepts and Value Engineering.
C312.2	Acquire knowledge on Process selection & Process Equipment selection
C312.3	Understand work Study, Method Study, Micro Motion Study and Time Study
C312.4	Understands the elements of cost, Over heads and steps in Making Cost Estimate.
C312.5	Understand the elements of Machining, cutting speed, feed, depth of cut & solve simple problems on Machining Time.

**COGNITIVE LEVEL LEGEND: R- REMEMBER, U- UNDERSTAND, A- APPLICATION**

COURSE OUTCOME		CL	LINKED PO	TEACHING HRS
C312.1	Understand process planning concepts and Value Engineering.	R/U/A	PO1, PO6, PO7	18
C312.2	Acquire knowledge on Process selection & Process Equipment selection	R/U/A	PO1, PO6, PO7	18
C312.3	Understand work Study, Method Study, Micro Motion Study and Time Study	R/U/A	PO1, PO6, PO7	18
C312.4	Understands the elements of cost, Over heads and steps in Making Cost Estimate.	R/U/A	PO1, PO2, PO6, PO7	18
C312.5	Understand the elements of Machining, cutting speed, feed, depth of cut & solve simple problems on Machining Time.	R/U/A	PO1, PO2, PO6, PO7	18
			<b>TOTAL SESSIONS</b>	<b>90</b>

**COURSE CONTENT AND BLUE PRINT OF MARKS FOR END EXAMINATION:**

UNIT NO	UNIT NAME	HOUR	MAX. MARKS PER UNIT	QUESTIONS TO BE SET FOR			MARKS WEIGHTAGE (%)
				R	U	A	
I	PROCESS PLANNING	18	33	3	10	20	20%
II	PROCESS SELECTION	18	33	3	10	20	20%
III	WORK STUDY	18	33	3	10	20	20%
IV	COST ESTIMATION	18	33	3	10	20	20%
V	MACHINING TIME CALCULATIONS	18	33	3	10	20	20%
	<b>TOTAL</b>	90	165	15	50	100	100

**COURSE-PO ATTAINMENT MATRIX:**

COURSE NAME	PROGRAMME OUTCOMES						
	1	2	3	4	5	6	7
PROCESS PLANNING AND COST ESTIMATION	3	–	–	–	2	3	3

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**N1ME312 - PROCESS PLANNING AND COST ESTIMATION  
DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>PROCESS PLANNING</b> Introduction - concept – Information required to do process planning - factors affecting process planning - process planning procedure - Make (Or) Buy decision using Break Even Analysis - simple problems. Manual process planning - Introduction of Automated process planning and generator process planning – Advantage of computer aided process planning – Principle of line Balancing - need for line balancing – Value Engineering –Definition - cost control Vs cost reduction - value analysis when to do - steps information needed - selection of product.</p>	<b>18</b>
<b>II</b>	<p><b>PROCESS SELECTION</b> Process selection - technological choice - specific component choice - Process flow choice – Factors affecting process selection - machine capacity – analysis of machine capacity - process and equipment selection procedure - Determination of man, machine and material requirements - simple problems - selection of material – jigs - fixtures etc. - Factors influencing choice of machinery - selection of machinery - simple problems - preparation of operation planning sheet for simple components.</p>	<b>18</b>
<b>III</b>	<p><b>WORK STUDY</b> Objectives of work study - Concept of work content – Techniques to reduce work content - method study – Procedure – Recording techniques used in method study - Micro motion study - Principles of motion economy - Therblings - Simo chart - cycle graph - Chrono cycle graph - work measurement - Basic Procedures for the conduct of time study - calculation of standard time - simple problems – Ergonomics – definition – objectives – applications - working environment - work place layout - other areas.</p>	<b>18</b>
<b>IV</b>	<p><b>COST ESTIMATION</b> Introduction – Definition - Purpose of cost estimation - cost estimation Vs Cost accounting - components of cost – direct cost - indirect cost - overhead expenses - estimation of cost elements -set up time and economic lot size - tool change time - Inspection time - performance factor – overheads - different methods of apportioning overheads – Data required for cost estimating - Steps in making a cost estimate – problems - estimation of production cost of simple components such as coupling, shaft, crank etc. – problems.</p>	<b>18</b>

<b>V</b>	<p><b>MACHINING TIME CALCULATIONS</b></p> <p>Elements of metal machining - cutting speed - feed - depth of cut - procedure for assigning cutting variables - calculation of machining time for different lathe operations like - turning - facing - chamfering - parting - knurling and forming- Calculation of machining time for operations on drilling machine - machining time for shaping, planning, slotting, broaching and sawing operations - Machining time for face milling and slab milling operations - timing for thread cutting - estimation of total unit time - Procedure for doing the above machining calculations with formulae used - simple problems.</p>	<b>18</b>
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**Text Books:**

- 1) Industrial Engineering & Management - O.P Khanna.
- 2) Industrial Engineering & Production Management - Martand Telsang

**Reference Books:**

- 1) Production Engineering - P.C.Sharma.
- 2) Production and Costing - GBS Narang and V.Kumar
- 3) Mechanical Estimating and Costing - Banga & Sharma.

## MODEL QUESTION PAPER -I

Term	: V	Time	: 3Hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Process Planning and Cost Estimation	Code	: N1ME312

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What are the advantages of generative process planning?
2. Define value engineering.
3. What is process selection?
4. What are Therbligs?
5. Define cost estimation
6. What is performance factor?
7. List the principle elements of metal machining.
8. State the various recording techniques used in method study.

### PART – B

9. What are the information's required to do process planning?
10. State the choice involved in the process selection.
11. State the principles of motion economy.
12. State the objectives of ergonomics.
13. What is the purpose of cost estimating?
14. Write the relationship between setup time and economic lot size.
15. Define cutting speed. Give the various factors on which the cutting speed depends.
16. The observed time from stop watch study of a job is 8 minutes. The rating factor is 98%. Fatigue allowance is 10%; personal allowance is 5%; process allowance is 10% and policy allowance is 15%. Determine the standard time for the job.

### PART – C

17. (a) Explain the automated process planning with the help of neat sketches. State its advantages.

(Or)

(b) 2500 components are required for an assembly Line. This component is available at the rate Rs.10 per piece, in the Local market. If the same component is to be manufactured in the factory itself, the fixed cost will be Rs.2500 and the variable cost will be Rs. 2 per piece. Decide whether to make or buy.

**[Turn over .....**

18. (a) Explain in detail the process and equipment selection procedure.

(Or)

(b) A component can be produced either by an automatic lathe or three centre lathes. Number of components made per year is 6000. The cost data for the two machines are given below.

	For one no.	
	Automatic Lathe	Centre Lathe
Initial investment	Rs.2,00,000	Rs.50,000
Useful Life	8 years	10 years
Motor power	15 HP	3 HP
Labour Charges	Rs.20 Per Hour	Rs.30 Per Hour
Time to produce 6000 Pieces	3000 Hrs	-
Time to produce 2000 Pieces in each machine	-	2900 Hrs

For both machines

Interest =18%  
Cost of power =Rs.1.50 per Unit  
Taxes and insurance = 8%  
Maintenance — annual=7.5%  
Depreciation =1% per year  
Labour overhead =25% on Labour

Which machine will you select?

19. (a) Explain briefly the various steps involved in the conduct of stop watch time study.

(Or)

(b) A job was broken into 10 elements. The observed time and the corresponding rating factors are given below.

Elements	1	2	3	4	5	6	7	8	9	10
Observed time in minute	0.8	1.0	0.7	0.8	0.7	1.0	1.1	0.9	0.8	0.7
RF in %	100	110	120	90	100	80	110	120	80	100

Calculate the standard time for the job. Assume rest allowance, process allowance and special allowance each to be 10% of the normal time.

[Turn over ....

20. (a) From the following data, calculate the total cost and selling Price for a job. Direct material=Rs.5500; manufacturing wages=Rs.3000; factory overheads to manufacturing wages=100%; non-manufacturing overheads to factory cost= 15% and profit on total cost=12%.

(Or)

(b) 40 forging are to be machined in four setups. Calculate the cost of production with the help of the following:

Machining time	=12 min per Forging.
Non—machining time	= 21 min per forging.
Setup time	= 45 min per setup
Tool Sharpening	= 5 min per forging
Fatigue	= 20%
Personal needs	= 5%
Tool change time	=10 min
ToolLife	=8 hrs
Checking time	=15 sec with 5 checks per forging
Performance factor	=1.4
Direct labour cost	= Rs. 5 per hour.

21. (a) Estimate the machining time required on the shaper to complete one cut on a block 600 x 900mm, if the cutting speed is 6m per min. The return time to cutting time ratio is 1:4 and the feed is 2mm per stroke. The clearance at each end is 75mm and neglect widthwise allowance.

(Or)

(b) A 63.5mm diameter plain milling cutter having 6 teeth is used to face mill operation on an aluminum block of 180mm Long and 30mm wide. The spindle speed is 1500rpm and the feed is 0.125mm per tooth per revolution. Find the cutting time.

## MODEL QUESTION PAPER -II

Term	: V	TIME	: 3 Hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Process Planning and Cost Estimation	Code	: N1ME312

- [ N.B:** (1) *Answer any FIVE Questions in each PART – A and PART – B. Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.*
- (2) *Answer division (a) or division (b) of each question in PART – C.*
- (3) *Each question carries 2 Marks in PART – A, 3 Marks in PART – B and 10 Marks in PART – C. ]*

### PART – A

1. State the two main types of cost?
2. What is machine efficiency?
3. List out two factors considered in selecting “Material” for manufacture?
4. What is process selection?
5. Name two reasons for excess work content
6. Define cost estimation?
7. List down any two methods of allocating “Over head”
8. What is cost reduction?

### PART – B

- 9 Write down three activities of process planning.
10. Give three situations for doing value analysis.
11. State the objectives of ergonomics
12. State the principles of motion economy.
13. Write the relationship between setup time and economic lot size
14. Enlist the applications of micro motion study.
15. Name any three expenditure considered as “Indirect expenses”
16. The observed time from stop watch study of a job is 10 minutes. The rating factor is 90%. Fatigue allowance is 10%; personal allowance is 5%; process allowance is 10% and policy allowance is 15%. Determine the standard time for the job.

**[Turn over .....**

**PART – C**

17. (a) Briefly explain the factors that are considered for taking “make or buy” decision

(Or)

(b) In the manufacturing unit 4000 components are required for an assembly Line. This component is available at the rate Rs.10 per piece, in the Local market. If the same component is to be manufactured in the factory itself, the fixed cost will be Rs.6000 and the variable cost will be Rs 4 per piece. Decide whether to make or buy.

18. (a) Discuss in detail the rules for deciding “operation sequence”

(Or)

(b) A component can be produced either by an automatic lathe or three centre lathes. Number of components made per year is 4000. The cost data for the two machines are given below.

	Automatic Lathe	Centre Lathe (For one no.)
Initial investment	Rs.1,00,000	Rs.30,000
Useful Life	6 years	8 years
Motor power	10 HP	5 HP
Labour Charges	Rs.10 Per Hour	Rs.15 Per Hour
Time to produce 6000 Pieces	2000 Hrs	-
Time to produce 2000 Pieces in each machine	-	1500 Hrs

For both machines

Interest =14%  
Cost of power =Rs.2 per Unit  
Taxes and insurance = 6%  
Maintenance – annual = 4.3 %  
Depreciation =2% per year  
Labour overhead =28% on Labour  
Which machine will you select?

19. (a) Write down the basic procedure followed for conducting method study. Briefly explain each step.

(Or)

(b) A job was broken into 10 elements. The observed time and the corresponding rating factors are given below.

[Turn over .....

Elements	1	2	3	4	5	6	7	8	9	10
Observed time in minute	0.6	2.0	1.7	4.8	0.9	1.3	1.2	1.9	1.8	1.7
RF in %	80	100	130	80	90	70	120	120	70	110

Calculate the standard time for the job. Assume rest allowance, process allowance and special allowance each to be 15% of the normal time.

20. (a) Describe the concept of economic lot size and setup time. Add sketch.

(Or)

(b) From the following data, calculate the total cost and selling Price for a job. Direct material=Rs.6000; manufacturing wages=Rs.1000; factory overheads to manufacturing wages=80%; non-manufacturing overheads to factory cost= 10% and profit on total cost=10%.

21. (a) Estimate the machining time required on the shaper to complete one cut on a plate 300 x 600 mm, if the cutting speed is 8m per min. The return time to cutting time ratio is 1:5 and the feed is 3mm per stroke. The clearance at each end is 72mm and widthwise allowance is 20mm.

(Or)

(b) A 60 mm diameter plain milling cutter having 8 teeth is used to face mill operation on an aluminum block of 190mm Long and 40 mm wide. The spindle speed is 1200rpm and the feed is 0.2mm per tooth per revolution. Find the cutting time.

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME401**

**Term : V**

**Course Name : ELECTIVE THEORY - I TOTAL QUALITY MANAGEMENT**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Total Quality Management	5	75	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topic	Hours
1	Basic Concepts of Total Quality Management	15
2	Continuous process improvement – Q-7 Tools	15
3	Statistical Fundamentals	15
4	Control charts	15
5	Management Planning tools & Bench marking	15
	<b>Total</b>	75

**Course Outcomes:**

On successful completion of the course, the student will be able to:

C401.1	Understand the concepts of TQM and appreciate the principles and benefits of TQM
C401.2	Interpret the various QC Tools for continuous process improvement
C401.3	Acquire basic knowledge on statistics
C401.4	Describe Control Charts and able to solve simple problems
C401.5	Acquire knowledge on Management Planning and Bench Marking

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO	Teaching Hrs
C401.1	Understand the concepts of TQM and appreciate the principles and benefits of TQM	R/U/A	PO1,PO2	15
C401.2	Interpret the various QC Tools for continuous process improvement	R/U/A	PO1,PO2,PO4	15
C401.3	Acquire basic knowledge on statistics	R/U/A	PO1,PO2,PO4	15
C401.4	Describe Control Charts and able to solve simple problems	R/U/A	PO1,PO2,PO4	15
C401.5	Acquire knowledge on Management Planning and Bench Marking	R/U/A	PO1,PO2	15
		<b>Total sessions</b>		75

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for			Marks weightage (%)
				R	U	A	
I	Basic Concepts of Total Quality Management	15	30	4	21	5	22 %
II	Continuous process improvement – Q-7 Tools	15	30	4	21	5	22 %
III	Statistical Fundamentals	15	30	4	21	5	22 %
IV	Control charts	15	25	2	18	5	17 %
V	Management Planning tools & Bench marking	15	25	2	18	5	17 %
<b>Total</b>			<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100 %</b>

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
<b>OTAL QUALITY MANAGEMENT</b>	<b>3</b>	<b>3</b>	-	<b>3</b>	-	-	-

*Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.*

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

### Contents: Theory

Unit	Name of the Topics	Hours
I	<p><b>BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT</b></p> <p>Quality-Definitions - Dimensions of quality - Brainstorming and its objectives - Introduction to TQM – Characteristics – Basic concepts – Elements – Pillars – Principles - Obstacles to TQM implementation – Potential benefits of TQM – Quality council – Duties – Responsibilities – Quality statements – Vision – Mission – Quality policy statements – Strategic planning – Seven steps to strategic planning – Deming philosophy- Customer delight - ISO 9001:2008 Quality Management System requirements and implementation.</p>	15
II	<p><b>CONTINUOUS PROCESS IMPROVEMENT – Q7 TOOLS</b></p> <p>Input / Output process model – Juran Trilogy – PDCA (Deming Wheel) cycle – 5S Concepts – SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE – needs and objectives – effective implementation of 5S concepts in an organisation - Housekeeping – Kaizen.</p> <p>Seven tools of quality control (Q-7 tools) – Check sheet – Types of check sheet – Histogram – Cause and effect diagram - Pareto diagram – Stratification Analysis – Scatter diagram-Graph/run charts – Control charts - Construction of above diagrams.</p> <p>Quality circle - concept of quality circle - Organisation of Quality circle and objectives of Quality circle.</p>	15
III	<p><b>STATISTICAL FUNDAMENTALS</b></p> <p>Types of Data – Collection of Data – Classification of Data – Tabular presentation of Data – Graphical representation of a frequency distribution – Comparison of Frequency distribution – Mean – Median – Mode – Comparison of measures of central tendency – Introduction to measures of dispersion – Sample – sampling - Normal curve – Sigma – Concept of six sigma – Principles – Process- Problems.</p>	15
IV	<p><b>CONTROL CHARTS</b></p> <p>Control chart – Types of control charts – Control chart for variables</p> <p>– Construction of X and R charts – control limits Vs specification limits – Process capability – Method of doing process capability Analysis – Measures of process capability – Problems.</p> <p>Attributes – Control charts – P chart – np chart – c chart – u chart – Construction of above diagrams – Problems - Comparison between variable chart and Attribute chart.</p>	15

<b>V</b>	<b>MANAGEMENT PLANNING TOOLS &amp; BENCH MARKING</b>	<b>15</b>
	<p>Affinity diagram – Radar Diagram - Inter Relationship diagram (Inter Relationship diagram)  – Tree diagram - Prioritization matrix – Matrix diagram – Decision tree – Arrow diagram  – Matrix data analysis diagram - Construction of above diagrams.</p> <p>Bench marking – Objectives of bench marking – Types – Bench marking process -  Benefits of Bench marking – Pit falls of Bench marking-Just In Time(JIT) concepts  and its objectives - Total Productive Maintenance(TPM) - Introduction, Objectives of  TPM -steps in implementing TPM.</p>	

### **Text Books:**

- 1) Total Quality Management, Date H.Besterfiled, Pearson Education Asia.
- 2) Total Quality Management, V.Jayakumar, Lakshmi Publications.(reprint 2005)
- 3) Training manual on ISO 9001 : 2000 & TQM, Girdhar J.Gyani, Raj Publishing House, Second Edition 2001.
- 4) Quality Management, Howard Cuitlow, Tata Mc Graw Hill, 1998

### **Reference Books:**

- 1) Total Quality Management, Oakiand.J.S. Butterworth Heinemann Ltd. Oxford 1989.
- 2) Quality Management- concepts and Tasks-Narayana.V and Sreenivasan.N.S., New Age International 1996.
- 3) Total Quality Management for engineers, Zeiri. Wood Head Publishers. 1991.
- 4) Quality Planning and Analysis, Juran J.M and Frank M.Gryna Jr., TMH. India.1982
- 5) ISO 9001, Brain Rethry, Productivity and Quality Publishing Pvt. Ltd. 1993.
- 6) Quality Auditing D.Mills, Chapman and Hall, 1993.

## MODEL QUESTION PAPER- I

Term	: V	Time	: 3 Hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Elective theory - I	Code	: N1ME401

Total Quality Management

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.**

**Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.**

**(2) Answer division (a) or division (b) of each question in PART – C.**

**(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B**

**and 10 Marks in PART – C. ]**

### PART – A

1. Define the term quality
2. What are the dimensions of quality?
3. When run chart is used?
4. Define Data.
5. Define frequency distribution.
6. List the various types of control charts.
7. When R charts are used?
8. Define concept of TPM.

### PART – B

9. State the quality statements of organization.
10. What is the purpose of scatter diagram?
11. Write the concept of quality circle.
12. Define mean, median and mode.
13. What is sampling?
14. Write the objectives of control charts.
15. Write short notes on np chart.
16. List the objectives of bench marking.

**[Turn over .....**

**PART – C**

17. (a) What are the three elements of quality statements? Explain them briefly with example.

*(Or)*

(b) What is meant by strategic planning? Write the seven steps procedure of strategic planning cycle.

18. (a) what is 5S? State the factors required for the implementation of 5S principle.

*(Or)*

(b) List out the seven tools of quality control. Explain briefly i) Histograms ii) Control charts.

19. (a) Explain the various methods that are used for graphical representation of a frequency distribution.

*(Or)*

(b) Describe in detail the steps of six sigma process.

20. (a) Discuss the need, construction and applications of control charts for variables.

*(Or)*

(b) Explain in detail

i) Process capability

ii) P-chart.

21. (a) Define and explain the construction of

i) Tree diagram

ii) Matrix data analysis diagram.

*(Or)*

(b) State objectives of bench marking and explain the types of bench marking.

## MODEL QUESTION PAPER- II

Term : V

Time : 3 Hrs

Programme : Diploma in Mechanical Engineering

Max. Marks : 75

Course : Elective theory - I

Code : N1ME401

Total Quality Management

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.**

**Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.**

**(2) Answer division (a) or division (b) of each question in PART – C.**

**(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B**

**and 10 Marks in PART – C. ]**

### PART – A

1. Define quality
2. State any two potential of TQM
3. What is meant by PDCA cycle?
4. List out any two seven tools of quality control.
5. State any two types of data.
6. What is meant by six sigma?
7. What is meant by control chart?
8. What is meant by affinity diagram?

### PART – B

9. Define vision and mission statement.
10. List out any three principles of TQM?
11. What are the three elements of Juran Trilogy?.
12. What are the types of check sheets commonly used?
13. What are the three measures of dispersion?
14. State any three objectives of control charts.
15. Distinguish any three difference between variable chart and attribute chart.
16. State any three objectives of benchmarking.

**[Turn over .....**

**PART – C**

17. (a) List out any ten obstacles in TPM.

*(Or)*

(b) Explain briefly about strategic planning process.

18. (a) what is 5S? Explain all the elements of 5S principle in detail.

*(Or)*

(b) Explain briefly about methodology of constructing using Pareto diagram.

19. (a) Explain the various methods that are used for graphical representation of a frequency distribution.

*(Or)*

(b) Briefly explain about the concept of six sigma principle.

20. (a) Explain briefly about methodology of constructing using control charts .

*(Or)*

(b) Explain briefly about process of constructing P- chart.

21. (a) (i) Explain briefly about the construction of arrow diagram

(ii) Explain briefly about the construction of matrix data analysis diagram

*(Or)*

(b) Write the step by step procedure to develop a TPM programme in an organization and Explain.

**VIRUDHUNAGAR S.VELLAICHAMY NADAR POLYTECHNIC COLLEGE  
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VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme** : DIPLOMA IN MECHANICAL ENGINEERING  
**Course code** : N1ME402  
**Term** : V  
**Course Name** : ELECTIVE THEORY - I  
**PRESS TOOLS**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Press Tools	5	75	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topics	Hours
I	Press working fundamentals, operations, and machinery	15
II	Press & press tool accessories and cutting dies	15
III	Bending and forming dies	15
IV	Drawing dies and dies for secondary operations	15
V	Fine blanking tool and specialized press tool applications	15
	<b>TOTAL</b>	<b>75</b>

**Topics and Allocation of Hours:**

UNIT	Topic	Hours
1	Press working fundamentals, operations, and machinery	15
2	Press & press tool accessories and cutting dies	15
3	Bending and forming dies	15
4	Drawing dies and dies for secondary operations	15
5	Fine blanking tool and specialized press tool applications	15
	<b>Total</b>	<b>75</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

C402.1	Appreciate the theory of press working operations and machinery.
C402.2	Familiarize the press tools and accessories.
C402.3	Acquire knowledge about the binding & forming dies.
C402.4	Understand the Drawing Dies and Dies for secondary operation.
C402.5	Acquire knowledge on Fine Blanking processes and special press tool applications.

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO	Teaching Hrs
C402.1	Appreciate the theory of press working operations and machinery.	R/U/A	PO1,PO2	15
C402.2	Familiarize the press tools and accessories.	R/U/A	PO1,PO2	15
C402.3	Acquire knowledge about the binding & forming dies.	R/U/A	PO1,PO2,PO4	15
C402.4	Understand the Drawing Dies and Dies for secondary operation.	R/U/A	PO1,PO2,PO4	15
C402.5	Acquire knowledge on Fine Blanking processes and special press tool applications.	R/U/A	PO1,PO2,PO4	15
		<b>Total sessions</b>		<b>75</b>

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for			Marks weight age (%)
				R	U	A	
I	Press working fundamentals, operations, and machinery	15	33	3	10	20	20 %
II	Press & press tool accessories and cutting dies	15	33	3	10	20	20 %
III	Bending and forming dies	15	33	3	10	20	20 %
IV	Drawing dies and dies for secondary operations	15	33	3	10	20	20 %
V	Fine blanking tool and specialized press tool applications	15	33	3	10	20	20 %
<b>Total</b>			<b>165</b>	<b>15</b>	<b>50</b>	<b>100</b>	<b>100 %</b>

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Press Tools	3	3		2			

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**N1ME402 - PRESS TOOLS  
DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>PRESS WORKING FUNDAMENTALS, OPERATIONS, AND MACHINERY :</b></p> <p>Shearing Theory-Critical stages of shearing, Features of a punched hole, features of the slug, burr. Clearance - Effects of Optimum, Excessive and Insufficient clearances, Clearance for blanking and Piercing, Land and Angular Clearance. Cutting Force – Methods to reduce cutting force, stripping force.</p> <p>Press working operations - Blanking, Piercing, Cutting off, Parting off, perforating, embossing, coining, bending, forming, drawing, curling, bulging, extrusion, swaging, trimming, and shaving. Safety in press working.</p> <p>Presses - Common types of Presses, Main parts of a typical power press, OBI Press, Specification of presses, Comparison of Mechanical, hydraulic and Pneumatic presses. Single action, double action and triple action presses.</p> <p>Press operating parameters – Tonnage, shut height, stroke, shut height adjustment, strokes per minute, die space. Special purpose presses – Press brake, transfer press, multi slide machine.</p>	<b>15</b>
<b>II</b>	<p><b>PRESS &amp; PRESS TOOL ACCESSORIES AND CUTTING DIES</b></p> <p>Press Feeding Mechanisms - Uncoilers, Straighteners and recoilers, Hand feed, hitch/grip feed, Roll feed, Hopper feeds, dial feeds, chutes, slides, magazine feeds. Ejection mechanism – Ejection by Gravity, air ejection, mechanical ejection, semi automatic and automatic ejection, Mechanical hands, ejection by next part.</p> <p>Parts and functions of a press tool - Punches, Dies, Stoppers, Trigger stops, Strippers – Fixed and Travelling, Gauges, Pilots-Methods of piloting, shanks -Strip layout, Economy factor.</p> <p>Cutting Dies - Construction and working of Blanking tool, Piercing tool, Progressive tool, Compound tool. Commercially available die components – Die sets, die set attachment devices, punches, die buttons, retainers, springs, fluid springs, die cushion and its types.</p>	<b>15</b>

<p><b>III</b></p>	<p><b>BENDING AND FORMING DIES:</b></p> <p>Bending of sheet metal – Bending theory, neutral axis, metal movement, spring back, methods of overcoming spring back. Bending Operations – Bending, flanging, hemming, curling, seaming, and corrugating. Types of Bending dies (construction and working principle) – V bending and its types, edge bending, U bending. Bending operations done using press brake.</p> <p>Forming dies – Construction and working principle of solid form dies, pad form dies, curling dies, embossing dies, coining dies, swaging dies, bulging dies, crimping, tube forming. Assembly dies - Riveting, tab stake, upset stake, crimping.</p>	<p><b>15</b></p>
<p><b>IV</b></p>	<p><b>DRAWING DIES AND DIES FOR SECONDARY OPERATIONS</b></p> <p>Drawing operations – Shallow drawing, deep drawing. Analysis of cup drawing - Stages of drawing. Variables of drawing - Bending and straightening variables, friction variables, compression variables, stretch forming variables, analysis of draw speed. Draw dies &amp; its construction and working principle – Conventional draw die, inverted draw die, redrawing and reverse drawing dies, drawing of square or rectangular shapes. Blank holders, blank holding pressure and its importance, air vents, drawing inserts, draw beads. Drawing with flexible tooling – Marform process, Hydro form process. Drawing defects, causes and remedies.</p> <p>Dies for secondary operations - Construction and working principle of Semi piercing dies, shear form dies, dies for formed contours, notching die, shaving die, side piercing die.</p>	<p><b>15</b></p>
<p><b>V</b></p>	<p><b>FINE BLANKING TOOL AND SPECIALISED PRESS TOOL APPLICATIONS</b></p> <p>Fine blanking - Definition and Applications of fine blanking, Working principle of fine blanking tool, V Ring, function of V ring. Comparison of fine blanking with blanking. Clearance and press force calculations. Fine Blanking Machines - Working principle, Ram movement, Mechanical drives, hydraulic drives, Machine force, Ring indenter force, counter force. Fine blanking tools - Compound die tooling system with sliding punch, compound die tooling with fixed punch. Specialized Press Tool Applications - Construction, advantage and applications of advanced</p>	<p><b>15</b></p>

	<p>multistage tooling, unit tooling, angular piercing tools, CNC turret press. Principle of Quick Die Change (QDC) – need and advantages. Single Minute Exchange of Dies (SMED) – concept need and advantages. Factors Affecting Tool Service Life - Introduction, Elements of Tool performance, Procedure for investigation of tool failure, Trouble shooting in press tools, effect of heat treatment on service life of tools.</p>	
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**Text Books:**

1. Donald F. Eary. & Edward A. Reed, “Techniques of Press working sheet metal”, Prentice-Hall,Inc.,
2. Donaldson, “Tool Design”, Tata McGraw-hill Book Company.
3. Eugene ostergaard.D, “Advanced die making”, McGraw-Hill Book

**Reference Books:**

1. Dr.John G.Nee, “Fundamentals of Tool Design”, Society of Manufacturing Engineers.
2. ASTME, "Tool Engineers Hand Book", McGraw-hill Book Company. .
3. Paquin.J.R, “Die design fundamentals”, Industrial Press Inc.,
4. Eugene ostergaard.D, “Basic die making”, McGraw-hill Book company,.
5. Ivana Suchy, “Hand book of Die Design”, McGraw-Hill Book company.
6. American Society of Metals – Hand book – Volume 4 ( Forming)

## **MODEL QUESTION PAPER - I**

Term	: V	TIME	: 3 Hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Elective theory - I Press Tools	Code	: N1ME402

- [ N.B:**
- (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.**
  - (2) Answer division (a) or division (b) of each question in PART – C.**
  - (3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### **PART – A**

1. What are the stages of cutting in press working?
2. What are the types of feeding devices used in press working?
3. Define spring back.
4. Define embossing.
5. What are the drawing variables?
6. Name any three secondary operations.
7. What is the purpose of 'V' ring?
8. What are the factors affecting tool life?

### **PART – B**

9. How presses are classified.
10. What is the functions of stripper plate?
11. What is pilot?
12. Define bulging operations.
13. Write down the types of forming dies.
14. What are the purpose of air vent?
15. What is fine blanking?
16. Define QDC process.

**[Turn over .....**

**PART – C**

17. (a) (i) Explain shear action in die cutting with neat sketch.

(ii) Explain the effect of clearance.

*(Or)*

(b) Sketch and explain Transfer press.

18. (a) What is feeding mechanism? and also explain any two feeding mechanism.

*(Or)*

(b) Explain compound die with neat sketch.

19. (a) Explain spring back and methods of overcoming spring back with neat sketch.

*(Or)*

(b) Explain solid form die with neat sketch.

20.(a) Draw and explain the drawing defects.

*(Or)*

(b) Sketch and explain

i) Hydroform process and

ii) Marform process.

21. (a) Sketch and explain compound type fine blanking tool with sliding punch.

*(Or)*

(b) Explain in detail the need and advantage of single minute exchange of dies.

## MODEL QUESTION PAPER -II

Term	: V	TIME	: 3 Hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Elective theory - I Press Tools	Code	: N1ME402

- [ N.B:**
- (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.**
  - (2) Answer division (a) or division (b) of each question in PART – C.**
  - (3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

- 1) What are the stages of cutting in press working?
- 2) What are the types of feeding devices used in press working?
- 3) Define spring back.
- 4) Define embossing.
- 5) What are the drawing variables?
- 6) Name any four secondary operations.
- 7) What is the purpose of ‘V’ ring?
- 8) What are the factors affecting tool life?

### PART – B

- 9) How presses are classified.
- 10) Write down the functions of stripper plate?
- 11) What is pilot?
- 12) Define bulging operations.
- 13) Write down the types of forming dies.
- 14) What is blank development?
- 15) What is fine blanking?
- 16) Define QDC process.

**[Turn over .....**

**PART - C**

17)a. (i) Explain shear action in die cutting with neat sketch.

ii) Define clearance and explain types of clearance

(Or)

b. Sketch and explain Transfer press and press brake.

18)a. What is feeding mechanism? and also explain any two feeding mechanism.

(Or)

b. Explain compound die with neat sketch.

19) a. Explain spring back and methods of overcoming spring back with neat sketch.

(Or)

b. Draw and explain solid form die and pad type form die with neat sketch.

20) a. Draw and explain the various drawing defects.

(Or)

b. Sketch and explain

i) Marform process.

ii) Hydroform process and

21) a. Sketch and explain compound type fine blanking tool with sliding punch.

(Or)

b. Explain in detail the need and advantage of single minute exchange of dies.

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VIRUDHUNAGAR – 626 001  
N1 - SCHEME

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1ME403**  
**Term : V**  
**Course Name : ELECTIVE THEORY - I**  
**RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Renewable Energy Sources and Energy Conservation	5	75	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

Unit	Topics	Hours
I	FUNDAMENTALS OF ENERGY, WIND ENERGY	15
II	SOLAR ENERGY, APPLICATION, STORAGE	15
III	SOLAR PHOTOVOLTAIC SYSTEM AND DESIGN, OCEAN, TIDAL, WAVE ENERGY	15
IV	BIO-ENERGY	15
V	ENERGY CONSERVATION TECHNIQUES AND ENERGY AUDIT	15
	<b>TOTAL</b>	<b>75</b>

**Course Outcomes:**

On successful completion of the course, the student will be able to:

<b>C403.1</b>	<b>Appreciate the importance of Renewable Energy and Wind Energy.</b>
<b>C403.2</b>	<b>Acquire knowledge on Solar Energy Collectors &amp; Thermal Energy Storage systems.</b>
<b>C403.3</b>	<b>Design the PV system and know the methods of tapping power from Ocean &amp; Waves.</b>
<b>C403.4</b>	<b>Understand the concepts of Bio Energy conversion systems.</b>
<b>C403.5</b>	<b>Appreciate the various Energy conservation techniques &amp; Energy Audits.</b>

**Course Outcome linkage to Cognitive Level:**

Cognitive Level Legend: R- Remember, U- Understand, A- Application

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
<b>C403.1</b>	<b>Appreciate the importance of Renewable Energy and Wind Energy.</b>	R/U/A	PO1, PO5	15
<b>C403.2</b>	<b>Acquire knowledge on Solar Energy Collectors &amp; Thermal Energy Storage systems.</b>	R/U/A	PO1, PO5	15
<b>C403.3</b>	<b>Design the PV system and know the methods of tapping power from Ocean &amp; Waves.</b>	R/U/A	PO1, PO5	15
<b>C403.4</b>	<b>Understand the concepts of Bio Energy conversion systems.</b>	R/U/A	PO1, PO5	15
<b>C403.5</b>	<b>Appreciate the various Energy conservation techniques &amp; Energy Audits.</b>	R/U/A	PO1, PO5, PO7.	15
			<b>Total sessions</b>	<b>75</b>

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	15	25	2	18	5	17.86
II	ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTORS	15	25	2	18	5	17.86
III	SENSORS AND MACHINE VISION	15	25	2	18	5	17.86
IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	15	25	2	18	5	17.86
V	ROBOT APPLICATIONS IN MANUFACTURING	15	25	2	18	5	17.86
I to V*			15	6	9	0	10.70
<b>Total</b>		<b>75</b>	<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100</b>

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Renewable Energy Sources and Energy Conservation	3	-	-	-	3	-	1

*Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.*

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**N1ME403 - RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION**

**DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>FUNDAMENTALS OF ENERGY</b> Introduction to Energy-Energy consumption and standard of living-classification of energy resources-consumption trend of primary energy resources-importance of renewable energy sources- energy for sustainable development.</p> <p><b>WIND ENERGY</b> Introduction-Basic principles of wind energy conversion: Nature of the wind, power in the wind, forces on the blades and wind energy conversion-wind data and energy estimation-site selection-classification of wind energy conversion systems- components of conversion systems-Advantages and Disadvantages-Types of wind machines-Horizontal axis machine-Vertical axis machine-Generating system-Energy Storage–Application of wind energy-Safety and environmental aspects.</p>	<b>15</b>
<b>II</b>	<p><b>SOLAR ENERGY:</b> Introduction – Solar radiation at the earth's surface-Solar Radiation measurements-Estimation of average solar Radiation.</p> <p><b>SOLAR ENERGY COLLECTORS-</b> Classifications-Flat plate collectors - Concentrating collectors-performance parameter-tracking system-compound parabolic concentrator-parabolic trough concentrators-concentrator with point focus-heliostats-comparisons of various collectors-efficiency of collector-selection of collector for various applications.</p> <p><b>SOLAR THERMAL APPLICATION:</b> Solar water heaters-Solar industrial heating system – Solar Refrigeration and Air-Conditioning Systems-Solar cookers-Solar furnaces-Solar greenhouse-Solar Distillation-Solar pond Electric power plant-Distributed Collector- Solar thermal Electric power plant.</p> <p><b>SOLAR THERMAL ENERGY STORAGE:</b> sensible storage-latent heat storage-thermo chemical storage</p>	<b>15</b>

<p>III</p>	<p><b>SOLAR PHOTOVOLTAIC SYSTEM AND DESIGN:</b>  Solar photovoltaic a brief history of PV,PV in silicon: basic principle, crystalline PV; reducing cost and raising efficiency, thin film PV, other innovative technologies, electrical characteristics of silicon PV cells and modules, grid connected PV system, cost of energy from PV, Environmental impact and safety.  System design of solar photovoltaic system: Load analysis-solar array Design-Battery Design-Simple formulas. System design procedure. Case Studies: Designing solar home lighting system -Designing stand alone solar PV Power plant - Designing solar PV water pumping system - Only arrives load capacity - solar array sizing - Battery sizing - Inverter capacity and mountings.  <b>OCEAN ENERGY, TIDAL &amp; WAVE ENERGY</b>  Ocean energy resources – principle's of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation – Energy utilization – basic principle of tidal power – components and operations of tidal power plant – Energy and Power forms of waves – Wave energy conversion devices.</p>	<p>15</p>
<p>IV</p>	<p><b>BIO – ENERGY</b>  Introduction – photo synthesis – usable forms of bio mass, their composition and fuel properties-Biomass resources – Biomass conversion technologies – Urban waste to energy conversion – Biomass gasification – biomass liquification – biomass to ethanol production – Biogas production from waste Biomass – types of bio gas plants - applications – Bio diesel production – Biomass energy programme in India.</p>	<p>15</p>
<p>V</p>	<p><b>ENERGY CONSERVATION TECHNIQUES AND ENERGY AUDIT:</b>  Definition, Energy audit - need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments  Energy Conservation Techniques- Need and importance of energy conservation -Principles of energy conservation- Methods of energy conservation-Cogeneration and its application-Combined cycle system-Concept of energy management-Study of different energy management techniques like-Analysis of input-Reuse and recycling of waste.  Economic approach of Energy Conservation-Costing of utilities like steam, compressed air, electricity and water-Ways of improving boiler efficiency-Thermal insulation, Critical thickness of insulation-Waste heat recovery systems, their applications, criteria for installing unit-An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.</p>	<p>15</p>

**Text Books:**

1. Non Conventional Energy Sources - G.D. Rai – Khanna Publishers, New Delhi,1999.
2. Non Conventional Energy Sources and Utilisation - R.K. Rajput - S.Chand & Company Ltd., 2012.

**Reference Books:**

1. Renewable Energy Sources - Twidell, J.W. and Weir, A. - EFN Spon Ltd., 1986.
2. Non-Conventional Energy Resources - B.H.Khan - Tata Mc Graw Hill, 2<sup>nd</sup> Edn, 2009.
3. Industrial energy conservation- D. A. Ray- Pergaman Press
4. Energy resource management- Kirpal Singh Jogi- Sarup and sons

## MODEL QUESTION PAPER -I

Term : V TIME : 3 Hrs  
Programme : Diploma in Mechanical Engineering Max. Marks : 75  
Course : Elective theory - I Renewable Energy Sources and Energy Conservation Code : N1ME403

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
And 10 Marks in PART – C. ]**

### PART – A

1. Define Primary Energy.
2. Define wind data.
3. What is solar green house?
4. What is meant by photo voltaic system?
5. Define ocean thermal energy.
6. Define biogas?
7. Define cogeneration.
8. What is meant by energy conservation?

### PART – B

9. State the merits of non conventional energy sources
10. Mention the instruments used for measurement of solar radiation.
11. What is wind energy?
12. What is photosynthesis process?
13. What is Liquification?
14. What is Bio Fouling?
15. What is meant by wave machines?
16. State the advantages of geo thermal energy

### PART – C

- 17 A i)What is Standard of Living?  
ii)Explain how Energy Consumption is correlated with standard of living.  
(Or)
- B i) What are the Technologies available for Sustainable Energy Development?  
ii)Explain First Generation Technology for Sustainable Energy Development.

**[Turn over .....**

- 18 A Explain with neat sketch the working of Sun Shine Recorder.  
(Or)  
B Explain with neat sketch the Solar Industrial Heating system for the developing process Hot Air.
- 19 A Explain with neat sketch the Basic Components of Wind Energy Conversion System.  
(Or)  
B Explain with neat sketch the open cycle Ocean Thermal Energy Conversion System.
- 20 A i)What are the various types of Bio Gas Plants?  
ii)Explain with neat sketch the working of Fixed Dome type Bio Gas Plant.  
(Or)  
B i)List the various types of Bio Mass Gasifier?  
ii)Explain with neat sketch the working of Updraft Gasifier.
- 21 A Sketch the Energy Pyramid & explain in detail how it can solve Energy Crisis.  
(Or)  
B What is Cogeneration & state its application in Energy Conservation.

## MODEL QUESTION PAPER II

Term	: V	TIME	: 3 Hrs
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Elective theory - I Renewable Energy Sources and Energy Conservation	Code	: N1ME403

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What is Energy?
2. What is Energy Star?
3. What is Wind Energy?
4. List the various solar radiation measuring equipments.
5. What is Photosynthesis?
6. Define Anaerobic Digestion.
7. What are the various methods of Energy Audit?
8. List the various types of Bio Mass Conversion Techniques.

### PART – B

9. What are the limitations of conventional energy sources
10. Explain the working of Sun Shine Recorder.
11. What is wind data?
12. What are the various types of Solar Energy Collector?
13. What is Pyrolysis?
14. What is Bio Fouling?
15. Differentiate between On Grid and Off Grid Solar power.
16. State the advantages of Solar Cooking.

**[Turn over .....**

### PART – C

- 17 A Explain in detail with neat sketch the Smart Grid Technology.  
(Or)  
B i) What are the various types of Wind Turbines?  
ii) Explain with neat sketch the working of any one type of Wind Turbine.
- 18 A Explain with neat sketch the construction and working of Pyranometer.  
(Or)  
B Explain with neat sketch the Solar Refrigeration and Air Conditioning System.
- 19 A Explain with neat sketch the construction and working of PV cell.  
(Or)  
B Explain with your own example the designing of Solar Home Lighting system.
- 20 A i) Explain the following terms used in Bio Gas Plants. a. Slurry b. Sludge c. Scum  
ii) Explain with neat sketch the working of Continuous type Bio Gas Plant.  
(Or)  
B Explain in detail the steps involved in the preparation of Bio Diesel from waste oil.
- 21 A Explain in detail the steps involved in Energy Audit.  
(Or)  
B What is Cogeneration? Explain how it can lead to Energy Conservation?

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VIRUDHUNAGAR – 626 001

**N1 – SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME313**

**Term : V**

**Course Name : PROCESS AUTOMATION PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Process Automation Practical	4	60	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

C313.1	Categorize the components of pneumatic circuits, Electro pneumatic circuits & Hydraulic circuits.
C313.2	Understand the use PLC system and its elements for processes control.
C313.3	Familiarise the working of function blocks in PLC.
C313.4	Control the automatic operation of pneumatic cylinder using PLC.
C313.5	Control sequential operation of pneumatic cylinder using PLC.

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO	Teaching Hrs
C313.1	Categorize the components of pneumatic circuits, Electro pneumatic circuits & Hydraulic circuits.	1,2,3,4,5,6,7,8	U,A	PO1,PO3	12
C313.2	Understand the use PLC system and its elements for processes control.	9	U,A	PO1,PO3	12
C313.3	Familiarise the working of function blocks in PLC.	10,11,12	U,A	PO1,PO3	12
C313.4	Control the automatic operation of pneumatic cylinder using PLC.	13,14,15	U,A	PO1,PO3	12
C313.5	Control sequential operation of pneumatic cylinder using PLC.	16	U,A	PO1,PO3	12

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Process Automation Practical	3	-	3	-	-	-	-

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**LIST OF EXERCISES**

**Pneumatics Lab.**

1. Direct operation of single and double acting cylinder.
2. Operation of double acting cylinder with quick exhaust valve.
3. Speed control of double acting cylinder using metering-in and metering-out circuits.
4. Automatic operation of double acting cylinder in single cycle - using limit switch.
5. Automatic operation of double acting cylinder in multi cycle - using limit switch.

## Hydraulics Lab.

6. Direct operation of double acting cylinder.
7. Direct operation of hydraulic motor.
8. Speed control of double acting cylinder metering-in and metering-out control.

## PLC Lab.

9. Direct operation of a motor / cylinder using latching circuit.
10. Operation of a motor / cylinder using 'AND' logic control and 'OR' control.
11. On-Delay control of a motor / cylinder and Off-Delay control of a motor / cylinder.
12. Automatic operation of a Double acting cylinder-single cycle.
13. Automatic operation of a Double acting cylinder-single cycle - forward, time delay, return.
14. Automatic operation of Double acting cylinder-Multi cycle.
15. Sequential operation of double acting cylinder and a motor.
16. Operation of double acting cylinder using HMI.
17. \*Demo experiment on Control of double acting cylinder using SCADA. (Not For Exam)

## Content Beyond Syllabus:

- ✚ Demonstration on Sequential Valve.

## LIST OF EQUIPMENTS

1.	Pneumatic Trainer Kit	- 2Nos
	(All Cylinders, Control Valves, Limit switches and other accessories)	
2.	Hydraulics Trainer Kit	- 1No.
	(All Cylinders, Control Valves, Limit switches and other accessories)	
3.	PLC kit.	- 2 Nos.
4.	Computer with software	- 5 Nos.
5	Easy port and syslink	- 1No.
6	Pressure and flow sensor	- 1No.

## END EXAMINATION

### Note:

- All the exercises have to be completed. Two exercises will be given for examination by selecting one exercise from Pneumatics Lab. or Hydraulics lab and one from PLC lab. All the exercises should be given in the question paper and students are allowed to select by a lot.
- Record note book should be submitted during examination.

### Detailed Allocation of Marks for External Assessment

Part A: Pneumatics/Hydraulics lab by lot	= 35 marks
Part B: One question from PLC lab	= 35 marks
Viva-voce	= 05 marks
<b>Total</b>	<b>= 75 marks</b>

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**VIRUDHUNAGAR – 626 001  
N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course Code : N1ME314**  
**Term : V**  
**Course Name : THERMAL AND AUTOMOBILE ENGINEERING  
PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATIONS:**

No. of Weeks per Semester: 15 Weeks

Course	Instructions		Examination			
	Hours / Week	Hours / Term	Marks		Duration	
Thermal and Automobile Engineering Practical	4	60	Internal Assessment	End Practical Examination	Total	3 Hrs
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C314.1</b>	Understand the flash and fire point and viscosity of oil.
<b>C314.2</b>	Able to draw the valve timing diagram and port timing diagram of petrol and diesel engines and Conduct performance test & Heat Balance test on IC engines
<b>C314.3</b>	Explain the construction and functional features of the power transmission systems, power trains and other engine parts. Familiarize electrical and electronics equipments used in automobile.

## Course Outcome linkage to Cognitive Level:

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO, PSO	Teaching Hrs
<b>C314.1</b>	Understand the flash and fire point and viscosity of oil.	<b>1,2</b>	R/U/A	PO1, PO2, PO4	8
<b>C314.2</b>	Able to draw the valve timing diagram and port timing diagram of petrol and diesel engines and Conduct performance test & Heat Balance test on IC engines	<b>3,4,5,6,7</b>	R/U/A	PO1, PO2, PO4	22
<b>C314.3</b>	Explain the construction and functional features of the power transmission systems, power trains and other engine parts. Familiarize electrical and electronics equipments used in automobile.	<b>8,9,10,11, 12,13,14, 15</b>	U/A	PO1, PO2, PO4	30

## Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
THERMAL AND AUTOMOBILE ENGINEERING PRACTICAL	3	3		3			

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## **List of Experiments:**

### **PART-A**

- 1) Determine flash and fire point of the given oil by using open cup apparatus and closed cup apparatus.
- 2) Determine the absolute viscosity of the given lubricating oil by using Redwood viscometer/ Say Bolt viscometer.
- 3) Draw a Port timing diagram of two stroke petrol (Or) diesel Engines.
- 4) Draw a Valve time diagram for four stroke petrol (Or) diesel engines.
- 5) To conduct a load test on a Petrol (Or) diesel Engines.
- 6) To conduct a Morse test on multi Cylinder petrol (Or) diesel engines.
- 7) To conduct a Heat balance test on a Four Stroke Petrol (Or) Diesel engines.

### **PART-B**

- 8) Dismantling, assembling of pressure plate, clutch plate and steering gear box.
- 9) Dismantling, inspecting and assembling of gear box and find out the gear ratios.
- 10) Dismantling, inspecting and assembling of final drive and differential units.  
Adjusting of backlash and correct tooth contact of crown and pinion of differential unit.
- 11) Removing camshaft, replacing timing gears, removing valves, lapping and adjusting valve Clearance.
- 12) Removing, servicing and replacing Solex carburettor (Or) MPFI system.
- 13) Dismantling and assembling of inline fuel injection pump (Or) CRDI system and Injectors
- 14) Test a battery with specific gravity test and charge the battery with constant ampere/ voltage method. Dismantling, overhauling and assembling of starter motor and alternator (Or) dynamo.

### **Content beyond syllabus:**

- ✚ Emission test on Petrol / Diesel Engine.

## **LIST OF EQUIPMENTS**

### **THERMAL PRACTICAL**

1. Open cup apparatus to determine Flash and fire points – 2 No
2. Close cup apparatus to determine Flash and fire points – 2 No
3. Redwood viscometer – 2 No
4. Saybolt viscometer – 2 No
5. 4 stroke cycle petrol engine Model – 1 No
6. 4 stroke cycle diesel engine Model – 1 No
7. 2 stroke cycle petrol engine Model – 1 No
8. Petrol (Or) Diesel engine of any make with following arrangements – 2 No  
Load test arrangement  
Heat balance test arrangement
9. Multi cylinder petrol engine of any make with Morse test setup – 1 No

### **AUTOMOBILE PRACTICAL**

1. Automobile Mechanic's tools-Complete Set - 2 Set
2. 4 stroke petrol engine- with all accessories - 1No
3. 4 stroke Diesel engine- with all accessories - 1 No
4. Internal circlip plier, bearing puller - 1 No
5. Feeler gauge to check valve clearance, hammer and accessories - 1 No
6. SOLEX carburetor - 1 No
7. MPFI. - 1 No
8. Inline Fuel Injection Pump - 1 No
9. CRDI - 1 No
10. Injectors. - 1 No
11. Clutch set arrangement with tools - 1 No
12. Complete gear box with tools - 1 No
13. Complete steering arrangement - 1 No
14. Differential unit with axles - 1 No
15. Battery - 1 No
16. Battery Charger - 1 No
17. Battery testing unit (Specific gravity) - 1 No
18. Starter Motor - 1 No
19. Alternator - 1 No
20. Dynamo - 1 No

## END EXAMINATION

**Note:**

- All the exercises have to be completed. Two exercises will be given for examination by selecting one exercise in each PART. All the exercises should be given in the question paper and students are allowed to select by a lot.
- Record note book should be submitted during examination.

### Detailed Allocation of Marks for External Assessment

**Part A : 35 Marks**

Observation / Tabulation : 10

Reading / Calculation : 15

Result / Graph / Diagram : 10

**Part –B : 35 Marks**

Dismantling : 10

Procedure / Observation : 15

Assembly : 10

**Viva-Voce : 05 Marks**

**Total : 75Marks**

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VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Course Name : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course Code : N1ME315**  
**TERM : V**  
**Course Title : COMPUTER AIDED DESIGN PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATIONS:**

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			Duration
	Hours/ Week	Hours/ Semester	Marks			
Computer Aided Design Practical	4	60	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C315.1</b>	Study the Solid Modeling Software package.
<b>C315.2</b>	Create and understand the views of the solid modeling and assemble the parts
<b>C315.3</b>	Sectioning the assembled part and create the orthographic views.

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO	Teaching Hrs
<b>C315.1</b>	Study the Solid Modeling Software package	<b>1,2,3,4,5,6,7,8,9</b>	R/U	PO1, PO2, PO4	8
<b>C315.2</b>	Create and understand the views of the solid modeling and assemble the parts	<b>1,2,3,4,5,6,7,8,9</b>	R/U/A	PO1, PO2, PO4, PO7	26
<b>C315.3</b>	Sectioning the assembled part and create the orthographic views.	<b>1,2,3,4,5,6,7,8,9</b>	R/U/A	PO1, PO2, PO4, PO7	26

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Computer Aided Design Practical	<b>3</b>	<b>3</b>	-	<b>3</b>	-	-	<b>3</b>

*Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.*

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## LIST OF EXERCISES

### Solid modeling (60 Hrs.)

#### **Introduction**

Part modeling - Datum Plane – constraint – sketch – dimensioning – extrude – revolve – sweep – blend – protrusion – extrusion – rib – shell – hole – round – chamfer – copy – mirror – assembly – align – orient.

#### **3D Drawing**

1. Geneva Wheel.
2. Bearing Block.
3. Bushed bearing.
4. Foot step bearing.
5. Gib and Cotter joint.
6. Screw Jack.
7. Connecting Rod.
8. Protected type flange coupling.
9. Universal coupling.

**Note:** Print the orthographic view and sectional view from the above assembled 3D drawing.

## LIST OF EQUIPMENTS

1.	Personal computer	- 30 Nos.
2.	Modeling package	- Sufficient to the strength
	(Solid works / PRO-E / CATIA / Unigraphics / AutoCAD etc.,	
3.	Laser Printer	- 1 No.

## END EXAMINATION

**Note:**

**All exercises should be completed. Any one exercise should be carried out By selecting one exercise in Solid modeling. The printouts must be kept Along With the examination paper.**

### Detailed Allocation of Marks for External Assessment

Part modeling	:	30
Assembly	:	20
Detailed view of Solid model	:	20
<b>Viva voce</b>	:	<b>05</b>
<b>Total</b>	:	<b>75</b>

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1ME316**  
**Term : VI**  
**Course Name : INDUSTRIAL ENGINEERING AND MANAGEMENT**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Industrial Engineering and Management	5	75	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

Unit	Topics	Hours
I	PLANT ENGINEERING AND PLANT SAFETY	15
II	WORK STUDY, METHOD STUDY AND WORK MEASUREMENT	15
III	PRODUCTION PLANNING AND QUALITY CONTROL	15
IV	PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIOAL BEHAVIOR	15
V	FINANCIAL AND MATERIAL MANAGEMENT	15
	<b>TOTAL</b>	<b>75</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

C316.1	Understand about Plant Engineering and Plant Safety.
C316.2	Interpret different work measurement techniques.
C316.3	Apply production planning and control & Quality Control concepts.
C316.4	Understand the principles of management and Organizational structure.
C316.5	Analyze Financial Functions, Inventory control system and the tools used in stock control.

**Course Outcome linkage to Cognitive Level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO	Teaching Hrs
C316.1	Understand about Plant Engineering and Plant Safety.	R/U/A	PO1,PO2	15
C316.2	Interpret different work measurement techniques.	R/U/A	PO1,PO2	15
C316.3	Apply production planning and control & Quality Control concepts.	R/U/A	PO1,PO2,PO4	15
C316.4	Understand the principles of management and Organizational structure.	R/U/A	PO1,PO2,PO4	15
C316.5	Analyze Financial Functions, Inventory control system and the tools used in stock control.	R/U/A	PO1,PO2,PO4,PO6	15
			<b>Total sessions</b>	75

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for			Marks weightage (%)
				R	U	A	
I	PLANT ENGINEERING AND PLANT SAFETY	15	25	2	18	5	17.86
II	WORK STUDY, METHOD STUDY AND WORK MEASUREMENT	15	25	2	18	5	17.86
III	PRODUCTION PLANNING AND QUALITY CONTROL	15	25	2	18	5	17.86
IV	PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIOAL BEHAVIOR:	15	25	2	18	5	17.86
V	FINANCIAL AND MATERIAL MANAGEMENT	15	25	2	18	5	17.86
I to V			15	6	9	0	10.70
<b>Total</b>		<b>75</b>	<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100 %</b>

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Industrial Engineering and Management	3	3	-	2	-	1	-

*Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.*

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## NIME316 – INDUSTRIAL ENGINEERING AND MANAGEMENT DETAILED SYLLABUS

### Contents: Theory

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>PLANT ENGINEERING AND PLANT SAFETY</b></p> <p><b>Plant Engineering :</b> Plant – Selection of site of industry – Plant layout – Principles of a good layout – types – process, product and fixed position – techniques to improve layout – Principles of material handling equipment – Plant maintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance.</p> <p><b>Plant Safety:</b> Importance –accident-causes and cost of an accident-accident proneness-prevention of accidents-Industrial disputes-settlement of Industrial disputes-Collective bargaining, conciliation, Mediation, arbitration-Indian Factories Act 1948 and its provisions related to health, welfare and safety.</p>	<b>15</b>
<b>II</b>	<p><b>WORK STUDY, METHOD STUDY AND WORK MEASUREMENT</b></p> <p><b>Work Study:</b> Productivity – Standard of living – method of improving productivity – Objectives – Importance of good working conditions.</p> <p><b>Method Study:</b> Definition – Objectives – Selection of a job for method study –Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart, Man machine chart, String diagram and flow diagram.</p> <p><b>Work Measurement:</b> Definition – Basic procedure in making a time study – Employees rating factor – Application of time allowances – Rest, Personal, Process, Special and Policy allowances – Calculation of standard time – Problems – Basic concept of production study – Techniques of work measurement-Ratio delay study, Synthesis from standard data, analytical estimating and Pre determined Motion Time System (PMTS).</p>	<b>15</b>
<b>III</b>	<p><b>PRODUCTION PLANNING AND QUALITY CONTROL</b></p> <p><b>Production Planning and Control:</b> Introduction – Major functions of production planning and control – Pre planning – Methods of</p>	<b>15</b>

	<p>forecasting – Routing and scheduling – Dispatching and controlling – Concept of Critical Path Method (CPM)-Description only. Production – types-Mass production, batch production and job order production- Characteristics – Economic Batch Quantity (EBQ) – Principles of product and process planning – make or buy decision.</p> <p><b>Quality Control:</b> Definition – Objectives – Types of inspection – First piece, Floor and centralized inspection – Advantages and disadvantages. Quality control – Statistical quality control – Types of measurements – Method of variables – Method of attributes – Uses of X, R, p and c charts – Operating Characteristics curve (O.C curve) – Sampling inspection – single and double sampling plan – Concept of ISO 9001:2008 Quality management</p> <p>System Registration Certification procedure – Benefits of ISO to the organization.</p>	
IV	<p><b>PRINCIPLES, PERSONNEL MANAGEMENT AND ORGANIZATIONAL BEHAVIOR:</b></p> <p><b>Principles of Management:</b> Definition of management– Administration - Organization – F.W. Taylor’s and Henry Fayol’s Principles of Management – Functions of Manager – Directing – Leadership -Styles of Leadership – Qualities of a good leader – Motivation – Positive and negativemotivation --Modern management techniques- Just In Time – Total Quality Management (TQM) – Quality circle – Zero defect concept – 5S Concept-Management Information Systems – Strategic management – SWOT Analysis -- Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) –Supply Chain Management (SCM) – Activity Based Management (ABM) – Global Perspective – Principles and brief description.</p> <p><b>Personnel Management:</b> Responsibility of human resource management – Selection procedure – Training of workers – Apprentice training – On the job training and vestibule school training – Job evaluation and merit rating – objectives and importance – wages and salary administration – Components of wages – Wage fixation – Type of wage payment – Halsey’s 50% plan, Rowan’s plan and Emerson’s efficiency plan – Problems. <b>Organizational behavior:</b> Definition – organization--Types of Organization – Line,Staff,Taylor’s Pure functional types – Line and staff and committee type –Organizational Approaches, individual behavior—causes—Environmentaleffect—Behavior and Performance, Perception-organizational implications.</p>	15
V	<p><b>FINANCIAL AND MATERIAL MANAGEMENT</b></p> <p><b>Financial Management:</b> Fixed and working capital – Resources of capital – shares preference and equity shares – debentures – Type of debentures – Public deposits, Factory costing – direct cost – indirect cost – Factory overhead – Selling price of a product – Profit – Problems. Depreciation – Causes – Methods - Straight line, sinking fund and percentage on diminishing value method – Problems.</p> <p><b>Material management:</b> Objectives of good stock control system – ABC analysis of inventory – Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level-Economic order quantity problems – supply chain management – Introduction – Purchasing procedure – Store keeping – Bin card.</p>	15

**Text Books:**

1. Industrial Engineering and Management, O.P. Khanna, Revised Edition Publications (P) Ltd – 2004, 67/4 Madras House, Daryaganj, New Delhi – 110002.
2. Engineering Economics and Management, T.R. Banga & S.C. Sharma, McGraw Hill Edition. 2 – 2001, New Delhi.
3. Herald Koontz and Heinz Wehrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition. Latest

**Reference Books:**

1. Management, A global perspective, Heinz Wehrich, Harold Koontz, 10<sup>th</sup> Edition, McGraw Hill International Edition. Latest.
2. Essentials of Management, 4th Edition, Joseph L. Massie, Prentice-Hall of India, New Delhi 2004.
3. S.Chandran, Organizational Behaviours, Vikas Publishing House Pvt. Ltd. Latest
4. M.Govindarajan and S.Natarajan, Principles of Management, Prentice Hall of India Pvt. Ltd. New Delhi. Latest.

## MODEL QUESTION PAPER - I

Term : VI Time : 3 Hours  
Programme : Diploma in Mechanical Engineering Max. Marks: 75  
Course : Industrial Engineering and Management Code : N1ME316

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What are the techniques used to improve Plant layout?
2. What is mean by accident proneness?
3. What is meant by productivity?
4. What are the major functions of PPC?
5. What is mean by make or buy decision?
6. Define management.
7. What is mean by shares?
8. State any two objectives of good stock control system?

### PART – B

9. Write the importance of plant maintenance.
10. Name the various method study tools.
11. Define work measurement.
12. Explain the functions of preplanning?
13. Write the functions of a manager in an industry.
14. State the advantages of JIT.
15. Write the causes of depreciation.
16. Comparison between preference shares and equity shares.

[ Turn over .....

**PART – C**

17. (a). What are the different types of plant layout? Explain any two types of layout with its advantages.

(Or)

(b). I. Explain the various causes of an accident.

II. Discuss the various methods of settlement of industrial disputes.

18. (a). Explain the basic procedure for conducting method study.

(Or)

(b). Write the short notes on the following:

I. Radio delay study

II. Analytical estimating

19. (a). What is forecasting? Explain the different techniques of Forecasting?

(Or)

(b). Write short notes on:

I. Double sampling plan.

II. OC Curve for sampling plan.

20. (a). Explain in details about Taylor's scientific management with principles.

(Or)

(b). I. Write short notes on organizational behavior and principle.

II. Explain the wages and salary administration?

21. (a). Explain by means of block diagram how the selling price of a product is determined.

(Or)

(b). Explain the total cost of inventory can be efficiently controlled by ABC analysis Technique.

## MODEL QUESTION PAPER - II

Term : VI

Time : 3 Hours

Programme : Diploma in Mechanical Engineering

Max. Marks: 75

Course : Industrial Engineering and Management

Code : N1ME316

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What is meant by preventive maintenance?
2. What is collective bargaining?
3. Define method study.
4. What is mean by dispatching?
5. Define statistical quality control.
6. Define communication.
7. Define breakeven point.
8. Write the importance of ABC analysis

### PART – B

9. State any three principles of material handling.
10. List out the methods of improving productivity.
11. Explain rating factors.
12. Explain critical path method.
13. Define administration and management.
14. What are the objectives of job evaluation?
15. Write the difference between debenture holder and share holder.
16. Explain supply chain management.

**[Turn over .....**

**PART – C**

17. (a). Explain the various factors to be considered for selection of site of industries.

(Or)

(b). State the important provision of factories act 1948 governing safety of workers.

18. (a). Explain the basic procedure for conducting a time study.

(Or)

(b). Explain the left hand and right hand process chart.

19. (a). Explain various types of production

(Or)

(b). Briefly explain the various types of inspection.

20. (a). Explain the three types of leadership with merits and demerits.

(Or)

(b). Explain the line and staff organization with advantages and disadvantages

21. (a). What is depreciation? Explain the causes of depreciation.

(Or)

(b). Explain with a diagram and derive the formula for EOQ.

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**N1 – SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1ME317**  
**Term : VI**  
**Course Name : COMPUTER AIDED DESIGN AND MANUFACTURING**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Computer Aided Design and Manufacturing	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topics	Hours
I	COMPUTER AIDED DESIGN	18
II	COMPUTER AIDED MANUFACTURING	18
III	CNC PROGRAMMING, RAPID PROTOTYPING	18
IV	COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE, ROBOT	18
V	CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE, AUGMENTED REALITY.	18
	<b>TOTAL</b>	<b>90</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C317.1</b>	Explain computer aided design process, transformation and geometric modeling.	
<b>C317.2</b>	Acquire knowledge about the computer assistance in the design process and PPC.	
<b>C317.3</b>	Learn the method of CNC programming and RAPID Prototyping.	
<b>C317.4</b>	Interpret CIM and FMS.	
<b>C317.5</b>	Acquire the knowledge in Concurrent Engineering, Product Development Cycle and Augmented Reality.	

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO	Teaching Hrs
<b>C317.1</b>	Explain computer aided design process, transformation and geometric modeling.	<b>R/U/A</b>	PO1, PO2, PSO1	18
<b>C317.2</b>	Acquire knowledge about the computer assistance in the design process and PPC.	<b>R/U/A</b>	PO1, PO2, PSO1	18
<b>C317.3</b>	Learn the method of CNC programming and RAPID Prototyping.	<b>R/U/A</b>	PO1, PO2, PO4, PSO1	18
<b>C317.4</b>	Interpret CIM and FMS	<b>R/U/A</b>	PO1, PO2, PO5, PSO1	18
<b>C317.5</b>	Acquire the knowledge in Concurrent Engineering, Product Development Cycle and Augmented Reality.	<b>R/U/A</b>	PO1, PO2, PO3, PO7, PSO1	18
			<b>Total sessions</b>	90

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	COMPUTER AIDED DESIGN	18	25	2	13	10	17.86 %
II	COMPUTER AIDED MANUFACTURING	18	25	2	13	10	17.86 %
III	CNC PROGRAMMING, RAPID PROTOTYPING	18	25	2	13	10	17.86 %
IV	COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE, ROBOT	18	25	2	13	10	17.86 %
V	CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE, AUGMENTED REALITY.	18	25	2	13	10	17.86 %
I to V*			15	6	9	0	10.70 %
	<b>Total</b>	<b>90</b>	<b>140</b>	<b>16</b>	<b>72</b>	<b>50</b>	<b>100 %</b>

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Computer Aided Design and Manufacturing	3	3	1	1	1	-	1

**Course-PSO Attainment Matrix:**

Course Name	Programme Specific Outcomes	
	1	2
Computer Aided Design and Manufacturing	3	-

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

# N1ME317 - COMPUTER AIDED DESIGN AND MANUFACTURING

## DETAILED SYLLABUS

### Contents: Theory

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>COMPUTER AIDED DESIGN:</b>  <b>Computer aided design:</b> Introduction – definition – Shigley’s design process – Ohsuga Model - CAD activities – benefits of CAD - CAD software packages.  <b>Transformations:</b> 2D &amp; 3D transformations – translation, scaling, rotation and concatenation.  <b>Geometric modelling:</b> Techniques - Wire frame modelling – applications – advantages and disadvantages. Surface modelling – types of surfaces – applications – advantages and disadvantages – Solid modelling – entities – advantages and disadvantages – Boolean operations - Boundary representation – Constructive Solid Geometry – Comparison.  <b>Graphics standard:</b> Definition – Need - GKS – OpenGL - IGES – DXF.  <b>Finite Element Analysis:</b> Introduction – Development - Basic steps – Advantage.</p>	<b>18</b>
<b>II</b>	<p><b>COMPUTER AIDED MANUFACTURING:</b>  <b>Computer Aided Manufacturing</b> Introduction - Definition – functions of CAM – benefits of CAM.  <b>Group technology:</b> Part families - Parts classification and coding - coding structure – Optiz system, MICLASS system and CODE System.  <b>Process Planning:</b> Introduction – Computer Assisted Process Planning (CAPP) – Types of CAPP - Variant type, Generative type – advantages of CAPP.  <b>Production Planning and Control (PPC):</b> Definition – objectives - Computer Integrated Production management system – Master Production Schedule (MPS) – Capacity Planning – Materials Requirement Planning (MRP)–Manufacturing Resources Planning (MRP-II)–Shop Floor Control system (SFC) - Just In Time manufacturing philosophy (JIT) - Introduction to Enterprise Resources Planning (ERP).</p>	<b>18</b>
<b>III</b>	<p><b>CNC PROGRAMMING, RAPID PROTOTYPING</b>  <b>CNC PART PROGRAMMING:</b> Manual part programming -coordinate system  <b>Datum points:</b> machine zero, work zero, tool zero - reference points - NC dimensioning – G codes and M codes – linear interpolation and circular interpolation - CNC program procedure - sub-program – canned cycles - stock removal – thread cutting – mirroring – drilling cycle – pocketing.</p>	<b>18</b>

	<p><b>Rapid prototyping:</b> Classification – subtractive – additive – advantages and applications - materials. Types - Stereo lithography (STL) – Fused deposition model (FDM) – Selective laser sintering (SLS) - three dimensional printing (3D) – Rapid tooling.</p>	
IV	<p><b>COMPUTER INTEGRATED MANUFACTURING, FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE, ROBOT</b></p> <p><b>CIM:</b> Introduction of CIM – concept of CIM - evolution of CIM – CIM wheel – Benefits – integrated CAD/CAM.</p> <p><b>FMS:</b> Introduction – FMS components – FMS layouts</p> <p><b>Types of FMS:</b> Flexible Manufacturing Cell (FMC) – Flexible Turning Cell (FTC) – Flexible Transfer Line (FTL) – Flexible Machining System (FMS) – benefits of FMS - introduction to intelligent manufacturing system.</p> <p><b>AGV:</b> Introduction – AGV - working principle – types – benefits.</p> <p><b>ROBOT:</b> Definition – robot configurations – basic robot motion – robot programming method – robotic sensors – end effectors – mechanical grippers – vacuum grippers</p> <p><b>Industrial applications of Robot:</b> Characteristics - material transfer and loading – welding -spray coating - assembly and inspection.</p>	18
V	<p><b>CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE, AUGMENTED REALITY.</b></p> <p><b>Concurrent Engineering:</b> Definition – Sequential Vs Concurrent engineering – need of CE – benefits of CE.</p> <p><b>Quality Function Deployment (QFD):</b> Definition – House of Quality (HOQ) – advantages – disadvantages. Steps in Failure Modes and Effects Analysis (FMEA) – Value Engineering (VE) – types of values – identification of poor value areas – techniques – benefits. Guide lines of Design for Manufacture and Assembly (DFMA).</p> <p><b>Product Development Cycle:</b> Product Life Cycle - New product development processes.</p> <p><b>Augmented Reality (AR)</b> – Introduction - concept – Applications.</p>	18

**Text Books:**

- 1) CAD/CAM/CIM , R.Radhakrishnan, S.Subramanian, New Age International Pvt. Ltd.
- 2) CAD/CAM , Mikell P.Groover, Emory Zimmers, Jr.Prentice Hall of India Pvt., Ltd.

**Reference Books:**

- 1) CAD/CAM Principles and Applications, Dr.P.N.Rao, Tata Mc Graw Hill Publishing Company Ltd.
- 2) CAD/CAM, Ibrahim Zeid, Mastering Tata McGraw-Hill Publishing Company Ltd., New Delhi.
- 3) Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell P. Groover, Pearson Education Asia.
- 4) Computer control of manufacturing systems, Yoram Koren, McGraw Hill Book.

## MODEL QUESTION PAPER - I

Term	: VI	Time	: 3 Hours
Programme	: Diploma in Mechanical Engineering	Max. Marks	: 75
Course	: Computer Aided Design and Manufacturing	Code	: N1ME317

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. Define CAD.
2. What is Graphics workstation?
3. What is Group Technology?
4. What is part programming?
5. Define Canned cycle.
6. What is FMS?
7. Define Concurrent engineering.
8. List the applications of Industrial Robot.

### PART – B

9. List out the benefits of CAD.
10. What are the common graphics standards in CAD/CAM application?
11. What is MICLASS system and explain in detail.
12. Write short notes on Shop floor control.
13. Explain the Linear Interpolation with neat sketch.
14. What are the benefits of rapid prototyping?
15. Write short notes on Flexible Manufacturing System.
16. List the applications of Augmented reality.

**[Turn over .....**

**PART – C**

17. (a). i) Explain the Shigley's design process.  
ii) Comparison of CSG and B-rep.  
(Or)  
(b). Explain the basic steps of Finite element analysis.
18. (a). i) Explain the Optic system of coding.  
ii) Explain with neat sketch the Variant type Capp system.  
(Or)  
(b). Write short notes on  
i) Manufacturing resource planning (MRP-II)  
ii) Enterprise Resources Planning (ERP).
19. (a). Write a part program to create a mirroring image in a CNC milling machine using a sub program.  
(Or)  
(b). i) Explain the NC dimensioning methods with example.  
ii) Explain Sterio Lithography process with neat sketch.
20. (a). i) Explain the activity of CIM Wheel.  
ii) Explain the working principle of AGV.  
(Or)  
(b). Explain any two Application of ROBOT.
21. (a). i) Distinguish between Sequential engineering and concurrent engineering .  
ii) Explain the basic steps in Failure Modes and Effects Analysis (FMEA)  
(Or)  
(b). Explain the guidelines of design for manufacture and assembly.

## MODEL QUESTION PAPER - II

Term : VI Time : 3 Hours  
Programme : Diploma in Mechanical Engineering Max. Marks : 75  
Course : Computer Aided Design and Manufacturing Code : N1ME317

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### **PART A**

1. Define CAD
2. What are the common graphics standard in CAD/CAM application?
3. What are the phases of SFC (Shop floor Control).
4. Define JIT philosophy in manufacturing. (Just in Time).
5. Define Canned cycle (or) fixed cycle.
6. Define Rapid prototyping.
7. List the benefits of AGV?
8. Define Augmented Reality.

### **PART – B**

9. State the CAD software packages
10. Comparison between CSG and B-rep.
11. Explain the functions of CAM
12. List the objectives of PPC.
13. What are the methods of creating part program?
14. List the applications of rapid prototyping
15. List the benefits of CIM.
16. Explain the types of Values.

### **PART C**

17. a) Explain the Basic steps of FEA.

(Or)

- b) i) Comparison between CSG and B-rep.  
(ii) Explain any three surface entities used in Surface Modeling

**Turn over .....**

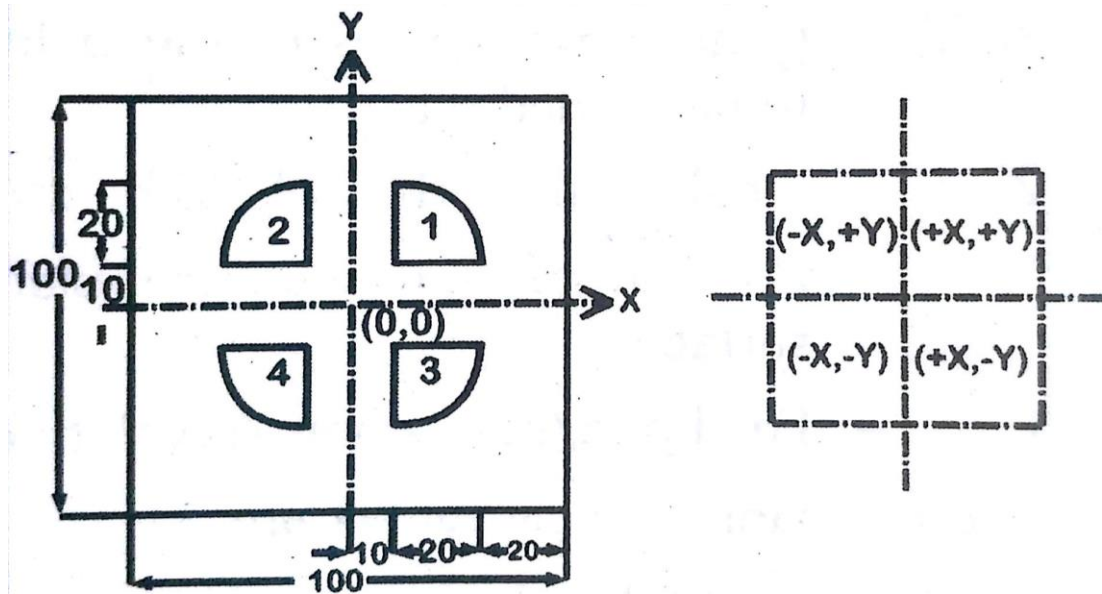
18. a) Explain the Computer Integrated production management system.

(Or)

b) i) Explain MICLASS system.

ii) Explain any one Approaches of CAPP.

19. a) Write a part program for contouring operation on the component as shown below, using Sub program and Mirroring.



(Or)

b) Explain about Stereolithography process.

20. a) Briefly explain about CIM wheel

(Or)

b) Explain about various configurations of robot.

21. a) i) Comparison between Sequential engineering and concurrent engineering

ii) Explain the process of Product Life Cycle.

(Or)

b) Explain about the new product development processes.

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**N1 - SCHEME**

**Programme** : DIPLOMA IN MECHANICAL ENGINEERING  
**Course code** : N1ME404  
**Term** : VI  
**Name** : ELECTIVE THEORY II - MECHANICAL INSTRUMENTATION

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Mechanical Instrumentation	5	75	Internal Assessment	End Examination	Total	3 Hrs
			25	75	100	

**Topics and Allocation of Hours:**

Unit	Topics	Hours
I	TYPES OF MEASUREMENT, MEASUREMENT OF <i>ERROR</i>	15
II	DISPLACEMENT MEASUREMENT- PRESSURE MEASUREMENT	15
III	TEMPERATURE MEASUREMENT- FLOW MEASUREMENTS	15
IV	MISCELLANEOUS MEASUREMENT	15
V	CONTROL SYSTEMS	15
	<b>TOTAL</b>	<b>75</b>

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C404.1</b>	Obtain knowledge on Measurement, Measuring Instrument and Measurement Error.
<b>C404.2</b>	Impart knowledge on Displacement and Pressure Measurement.
<b>C404.3</b>	Acquire knowledge on Temperature and Flow Measurement.
<b>C404.4</b>	Gain knowledge on Sound measurement, Humidity measurement, Force & power measurement, Speed Measurement & strain Measurement.
<b>C404.5</b>	Understand Control Systems and its types

**Course Outcome linkage to Cognitive Level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
<b>C404.1</b>	Obtain knowledge on Measurement, Measuring Instrument and Measurement Error.	R/U/A	PO1, PO2	18
<b>C404.2</b>	Impart knowledge on Displacement and Pressure Measurement.	R/U/A	PO1, PO2	18
<b>C404.3</b>	Acquire knowledge on Temperature and Flow Measurement.	R/U/A	PO1, PO2	18
<b>C404.4</b>	Gain knowledge on Sound measurement, Humidity measurement, Force & power measurement, Speed Measurement & strain Measurement.	R/U/A	PO1, PO2	18
<b>C404.5</b>	Understand Control Systems and its types	R/U/A	PO1, PO2. PO7	18
		<b>Total sessions</b>		90

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	TYPES OF MEASUREMENT, MEASUREMENT OF <i>ERROR</i>	18	25	2	18	5	17.86
II	DISPLACEMENT MEASUREMENT-PRESSURE MEASUREMENT	18	25	2	18	5	17.86
III	TEMPERATURE MEASUREMENT-FLOW MEASUREMENTS	18	25	2	18	5	17.86
IV	MISCELLANEOUS MEASUREMENT	18	25	2	18	5	17.86
V	CONTROL SYSTEMS	18	25	2	18	5	17.86
I to V*			15	6	9	0	10.70
	<b>Total</b>	90	140	16	99	25	100

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
MECHANICAL INSTRUMENTATION	<b>3</b>	<b>3</b>					<b>1</b>

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## NIME404 – MECHANICAL INSTRUMENTATION

### DETAILED SYLLABUS

#### Contents: Theory

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>Types of measurement-</b> classification of instruments - static terms and characteristics - Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity.</p> <p>Dynamic characteristics - Speed of response, Fidelity and Dynamic errors, overshoot.</p> <p><b>Measurement of error</b> - Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors</p> <p><b>Transducers :</b> Classification of transducers, active and passive, resistive, inductive, capacitive, piezo-resistive, thermo resistive.</p>	
<b>II</b>	<p><b>Displacement Measurement</b> -Capacitive transducer, Potentiometer, LVDT, RVDT, Specification, Selection &amp; application of displacement transducer. Optical measurement scale and encoders.</p> <p><b>Pressure Measurement:</b> Low pressure gauges- McLeod Gauge, Thermal conductivity gauge, Ionization gauge, Thermocouple vacuum gauge, Pirani gauge.</p> <p>High Pressure gauge-Diaphragm, Bellows, Bourdon tube, Electrical resistance type, Photoelectric pressure transducers, piezoelectric type, Variable capacitor type.</p>	<b>15</b>
<b>III</b>	<p><b>Temperature Measurement - :</b></p> <p>Non-electrical methods - Bimetal, Liquid in glass thermometer and Pressure thermometer.</p> <p>Electrical methods -RTD, Platinum resistance thermometer, Thermistor, Thermoelectric methods - elements of thermocouple, Seebek series, law of Intermediate metals, thermo emf measurement.</p> <p><b>Flow Measurements:</b> Variable area meter - Rota meter, Variable velocity meter – Anemometer, Special flow meter - Hot wire anemometer, Electromagnetic flowmeter, Ultrasonic flow meter, Turbine meter ,Vortex shedding flow meter.</p>	<b>15</b>
<b>IV</b>	<p><b>Miscellaneous Measurement:</b> Introduction to sound measurement and study of Electro dynamic microphone and Carbon microphone.</p> <p>Humidity measurement –Hair hygrometer, Sling psychrometer, Liquid level measurement – direct and indirect methods.</p> <p>Force &amp; Shaft power measurement - Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer. Speed measurement -Eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter &amp; timer, Slipping Clutch Tachometer, Electrical Tachometers, Contact less Electrical tachometer, Inductive Pick Up, Capacitive Pick Up, Stroboscope, Strain Measurement - Stress-strain relation, types of strain gauges, strain gauge materials, resistance strain gauge- bonded and unbounded, types (foil, semiconductor, wire wound gauges), selection and installation of strain gauges load cells, rosettes.</p>	<b>15</b>

<b>V</b>	<p><b>Control Systems :</b> Block diagram of automatic control system, closed loop system, open loop system, feedback control system, feed forward control system, servomotor mechanism.</p> <p>Comparison of hydraulic, pneumatic, electronic control systems, Control action: Proportional, Integral, derivative, PI, PD, PID. Applications of measurements and control for setup for boilers, air conditioners, motor speed control.</p>	<b>15</b>
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**Text Books:**

1. Mechanical Measurements & Control-D.S.Kumar-Metropolitan Publications, New Delhi.
2. Mechanical & Industrial Measurements-R.K.Jain-Khanna Publications, New Delhi

**Reference books:**

1. Mechanical Measurements & Instrumentation-A.K.Sawhney-Dhanpat Rai & Sons, New Delhi.
2. Measurement Systems-E. O. Doebelin-Tata McGraw Hill Publications.
3. Mechanical Measurement & Control-R.V. Jalgaonkar-Everest Publishing House, Pune.

## MODEL QUESTION PAPER - I

Term : VI Time : 3Hours  
Programme : Diploma in Mechanical Engineering Max. Marks : 75  
Course : Elective Theory – II Mechanical Instrumentation Code : N1ME404

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What is accuracy?
2. What are the types of measurement?
3. What is the expansion of LVDT?
4. What are the types of transducer?
5. List the types of thermometer.
6. What are the elements of thermocouple?
7. What is the purpose of hygrometer?
8. List the different types of actions of control system?

### PART – B

9. What are the differences between accuracy and precision?
10. Explain any two types of transducers
11. Explain LVDT.
12. Explain any one non electrical method of temperature measurement.
13. What is humidity measurement?
14. Explain the types of strain gauges.
15. Draw the block diagram of automatic control system and mention its parts.
16. Compare the hydraulic and electromagnetic control system.

**[Turn over .....**

**PART – C**

17. (a) Briefly explain the types of measurement?  
(Or)
- (b) Define Measurement of error and classification of error?
18. (a) Write the brief notes on selection and application of displacement transducer?  
(Or)
- (b) Explain with short notes on any two types of pressure gauge?
19. (a) Explains with neat sketch platinum resistance thermometer?  
(Or)
- (b) Explain with net sketch electromagnetic flow meter?
20. (a) Writes the function and application of strain gauge transmission dynamometer?  
(Or)
- (b) Write with neat sketch stroboscope and its application?
21. (a) Write short notes on automatic control system with block diagram?  
(Or)
- (b) Write the differences between feed forward and feedback system?

## MODEL QUESTION PAPER - II

Term : VI Time : 3Hours  
Programme : Diploma in Mechanical Engineering Max. Marks : 75  
Course : Elective Theory – II - Mechanical Instrumentation Code : N1ME404

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. Define range and span.
2. List the classification of error.
3. What is strain gauge?
4. What is potentiometer?
5. List out the types of ultrasonic flow meter.
6. What is dynamometer?
7. What is open loop system?
8. What is feedback?

### PART – B

9. What are the objectives of measurement?
10. Differentiate between fidelity and dynamic error.
11. What are the advantages and disadvantages of bourdon tubes?
12. Draw the circuit diagram of Wheatstone bridge for RTD
13. State the advantages and disadvantages for vortex shedding flow meter.
14. State the advantages and disadvantages sling psychomotor.
15. Explain stress strain relationship.
16. Compare the open and close loop system.

**[Turn over .....**

**PART – C**

17. (a) Briefly describe the static and dynamic characteristics of measuring instrument.

(Or)

(b) Explain any two types of transducer with simple sketch.

18. (a) Explain rotary variable differential transducer with neat sketch .Also state its advantages and disadvantages?

(Or)

(b) Briefly explain piezoelectric pressure transducer with a neat sketch. State its advantages and disadvantages?

19. (a) Explains with neat sketch Bi-metallic thermometer with a simple sketch. Also state its advantages and disadvantages?

(Or)

(b) Explain turbine flow meter with neat sketch.

20. (a) Explain in detail about capacitive pickup tachometer with neat sketch.

(Or)

(b) Explain capacitance level indicator with a neat sketch. Also state its advantages and disadvantages.

21. (a) Explain servo motor mechanism with neat sketch.

(Or)

(b) Explain PID controller with a neat sketch.

**VIRUDHUNAGAR S.VELLAICHAMY NADAR POLYTECHNIC COLLEGE  
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VIRUDHUNAGAR – 626 001

**N1 – SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME405**

**Term : VI**

**Course Name : ELECTIVE THEORY II - ROBOTICS**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Robotics	5	75	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topics	Hours
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	15
II	ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTORS	15
III	SENSORS AND MACHINE VISION	15
IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	15
V	ROBOT APPLICATIONS IN MANUFACTURING	15
	TOTAL	75

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C405.1</b>	<b>Understand the fundamentals of Robot Technology.</b>
<b>C405.2</b>	<b>Acquire knowledge on various Drives and Controllers used in Robot.</b>
<b>C405.3</b>	<b>Develop knowledge on the role of Sensors and Machine Vision system.</b>
<b>C405.4</b>	<b>Acquire skills to program &amp; control the Robot</b>
<b>C405.5</b>	<b>Appreciate the application of Robot and acquire knowledge on A.I</b>

**Course outcomes linkage to Cognitive level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
<b>C405.1</b>	<b>Understand the fundamentals of Robot Technology.</b>	<b>R/U/A</b>	PO1, PO2, PSO1	15
<b>C405.2</b>	<b>Acquire knowledge on various Drives and Controllers used in Robot.</b>	<b>R/U/A</b>	PO1, PO2, PSO1	15
<b>C405.3</b>	<b>Develop knowledge on the role of Sensors and Machine Vision system.</b>	<b>R/U/A</b>	PO1, PO2, PSO1	15
<b>C405.4</b>	<b>Acquire skills to program &amp; control the Robot</b>	<b>R/U/A</b>	PO1, PO2, PSO1	15
<b>C405.5</b>	<b>Appreciate the application of Robot and acquire knowledge on A.I</b>	<b>R/U/A</b>	PO1, PO2, PO7, PSO1	15
<b>Total sessions</b>				<b>75</b>

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	15	25	2	18	5	17.86
II	ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTORS	15	25	2	18	5	17.86
III	SENSORS AND MACHINE VISION	15	25	2	18	5	17.86
IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	15	25	2	18	5	17.86
V	ROBOT APPLICATIONS IN MANUFACTURING	15	25	2	18	5	17.86
I to V*			15	6	9	0	10.70
<b>Total</b>		<b>75</b>	<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100</b>

**\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit**

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Robotics	3	3					1

**Course-PSO Attainment Matrix:**

Course Name	Programme Specific Outcomes	
	1	2
Robotics	3	

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**NIME405 - ROBOTICS  
DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<b>FUNDAMENTALS OF ROBOT TECHNOLOGY</b> Introduction – History of robot - Definitions-Robot Anatomy – Basic configuration of Robotics – Robot Components – Manipulator, End effector, Driving system, Controller and Sensors. Mechanical arm – Degrees of freedom – Links and joints – Types of joints – Joint notation scheme – Pitch, Yaw, Roll – Classification of robots – Work envelope, Work Volume – Effect of structure on Control ,Work envelop and Work volume. Introduction to ABB robot.	<b>15</b>
<b>II</b>	<b>ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTORS</b> Robot controller – Configuration - Four types of controls – Open loop and closed loop controls – Speed of response and stability – Precision of movements: Spatial resolutions, accuracy and repeatability. Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – Stepper motors, DC Servo motors and AC Servo motors – Salient features – Applications and Comparisons of Drives. End effecters – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Two fingered and Three fingered Grippers, Internal and External Grippers – End Of Arm Tooling (EOAT)- Selection and Design considerations.	<b>15</b>
<b>III</b>	<b>SENSORS AND MACHINE VISION</b> Requirements of Sensors – Sensor devices used in robot work cell - Principles and applications of the following types of sensors – Position sensors: Piezo-electric sensors, LVDT, Resolvers, Optical encoders and	<b>15</b>

	Pneumatic position sensors – Range sensors – Proximity sensors: Inductive, Capacitive, Ultrasonic and Optical proximity sensors – Touch sensors: Binary sensors, Analog sensors – Wrist sensors – Slip sensors. Machine vision system – Camera – Frame grabber – Sensing and digitizing image data – Signal conversion – Image storage – Lighting techniques – Image processing and analysis – Data reduction: Edge detection, Feature extraction and object recognition – Applications – Inspection, Identification, Visual serving and navigation.	
<b>IV</b>	<b>ROBOT KINEMATICS AND ROBOT PROGRAMMING</b> Forward kinematics, Inverse kinematics and differences – Forward kinematics and Reverse kinematics of manipulators with Two and Three degrees of freedom – Deviations. – Robot dynamics – Static analysis - Robot programming – Teach pendant programming – Lead through programming – Robot programming languages – RAPID Programming – Motion commands, Sensor commands, End effector commands and Simple programs	<b>15</b>
<b>V</b>	<b>ROBOT APPLICATIONS IN MANUFACTURING</b> Robot applications – Material handling – Press loading and unloading – Die casting – Machine tool loading and unloading – Spot welding – Arc welding – Spray painting – Assembling – Finishing – Automatic Guided Vehicle – Adopting robots to workstations – Requisite robot characteristics and Non requisite robot characteristics – Stages in selecting robots for industrial applications – Safety considerations for robot operations – Robotics in the future and characteristics task– Economical analysis of robots – Social implications.	<b>15</b>

**Text Books:**

- 1) Industrial Robotics – Technology, Programming and Applications, .P.Groover, MC Graw Hill, 2001

**Reference Books:**

- 1) Robotics Control, Sensing, Vision and Intelligence, Fu.K.S.Gonzalez.R.C., and Lee C.S.G, McGraw-Hill Book Co., 1987
- 2) Robotics for Engineers, Yoram Koren, McGraw-Hill Book Co., 1992
- 3) Robotics and Image Processing, Janakiraman.P.A, Tata McGraw-Hill, 1995

## MODEL QUESTION PAPER - I

Term : VI  
Programme : Diploma in Mechanical Engineering  
Course : Elective Theory II - Robotics

Time: 3 Hrs  
Max.Marks : 75  
Code: N1ME405

- [ N.B.: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART-A

1. Define the term Robotics.
2. What is meant by Work envelope?
3. What is meant by open loop control system?
4. What is meant by accuracy of Robot?
5. What is a proximity sensor?
6. State any two techniques in image processing and analysis.
7. What are the types of Robot programming language?
8. How are the Robots classified based upon the configuration?

### PART- B

9. Sketch and explain the various type Lower Pair Connectors.
10. What do you mean by Degrees of Freedom?
11. What are the various types of End Effectors?
12. What is a Piezo-electric sensor?
13. What is meant by Reverse Kinematics?
14. What is Lead through programming?
15. How are the Robot programming Languages classified?
16. What are the advantages of Future Robots?

**[Turn over .....**

- 2 -  
**PART- C**

17. (a). Describe with neat sketch the basic Components of Robot.  
(Or)
- (b). i. What are the various types of Joint available in Robot?  
ii. Specify the Joint Notation Scheme for any type of Robot.
18. (a). Explain with neat sketch the Pneumatic drive system used in Robots.  
(Or)
- (b). i. What are the various types of Grippers?  
ii. Explain with neat sketch the working of Vacuum Gripper.
19. (a). Explain the machine vision Applications in Robots.  
(Or)
- (b). Explain the operation of Ultrasonic sensor with a neat sketch.
20. (a). Explain Forward Transformation of manipulator with two degrees of freedom.  
(Or)
- (b). Explain motion commands and sensor commands with an example.
21. (a). Explain Requisite and non requisite Robot characteristics.  
(Or)
- (b). Explain the Robot applications in the field of machine tool loading and unloading Operations.

## MODEL QUESTION PAPER - II

Term : VI  
Programme : Diploma in Mechanical Engineering  
Course : Elective Theory II - Robotics

Time : 3 Hrs  
Max.Marks : 75  
Code : N1ME405

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART-A

1. Define Robot.
2. What do you mean by reach of the Robot?
3. List the types of control system.
4. What is resolution of Robot?
5. What are the various types of proximity sensor?
6. What are the various data reduction techniques used in digital image processing?
7. List the types of Robot work cell layouts?
8. How are the Robots classified based upon the configuration?

### PART- B

9. Sketch and Robot for the given Joint Notation Scheme -- TRT : R
10. State the advantages of Jointed arm configuration Robot.
11. How are the Mechanical Grippers classified?
12. Differentiate between Active Transducer and Passive Transducer.
13. What is meant by Forward Kinematics?
14. What is Teach Pendant programming?
15. What do you mean by Interlocks in Robot Work Cell?
16. What are the techniques used for Object Recognition in Machine Vision?

**[Turn over .....**

- 2 -  
**PART- C**

17. (a). Explain with neat sketch the configuration of Robot.  
(Or)
- (b). What are the various types of Lower Pair Connectors? Explain the DOF of each lower pair connector with neat sketch.
18. (a). Explain with neat sketch the Hydraulic drive system used in Robots.  
(Or)
- (b). i. What are the various types of Magnetic Grippers?  
ii. Explain with neat sketch the working any one type of Magnetic Gripper.
19. (a). Explain the construction and operation of CCD Camera.  
(Or)
- (b). i. What are the various types of position sensors?  
ii. Explain the operation of LVDT with a neat sketch.
20. (a). Explain Forward Kinematics of manipulator with two degrees of freedom.  
(Or)
- (b). Explain motion commands and sensor commands with an example.
21. (a). Explain Requisite and non requisite Robot characteristics.  
(Or)
- (b). Explain the Robot applications in Welding? State its advantages & limitations.

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VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME406**

**Term : VI**

**Course Name : ELECTIVE THEORY II  
REFRIGERATION AND AIR CONDITIONING**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Refrigeration and Air Conditioning	5	75	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topic	Hours
1	REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS	15
2	VAPOUR COMPRESSION & ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS	15
3	REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION	15
4	PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS	15
5	COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES	15
	<b>Total</b>	75

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C406.1</b>	<b>Acquire the knowledge on Refrigeration system and Refrigeration Equipments.</b>
<b>C406.2</b>	<b>The knowledge about the difference between VCRS and VARS and the latest technology of the advance of cryogenic Refrigeration systems.</b>
<b>C406.3</b>	<b>Understand the working of Refrigeration flow controls and learn the types of Refrigerants</b>
<b>C406.4</b>	<b>Develop the knowledge on using Psychometric Chart and solve the problems.</b>
<b>C406.5</b>	<b>Acquire skills to Estimate the cooling load for the given requirement and the concepts and working of Ice Builder, Ice Harvester, VRF &amp; VPF.</b>

**Course outcomes linkage to Cognitive level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO	Teaching Hrs
C406.1	Acquire the knowledge on Refrigeration system and Refrigeration Equipments.	R/U/A	PO1,PO7	15
C406.2	The knowledge about the difference between VCRS and VARS and the latest technology of the advance of cryogenic Refrigeration	R/U/A	PO1,PO5	15
C406.3	Understand the working of Refrigeration flow controls and learn the types of Refrigerants & lubricants.	R/U/A	PO5,PO7	15
C406.4	Acquire skills to solve problems using Psychometric Chart.	R/U/A	PO1,PO2,PO5,PO7	15
C406.5	Acquire skills to Estimate the cooling load for the given requirement. Understand the concepts and working of Ice Builder, Ice Harvester, VRF & VPF.	R/U/A	PO1,PO2,PO3,PO5 ,PO7	15
<b>Total sessions</b>				<b>75</b>

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for			Marks weightage (%)
				R	U	A	
I	REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS	15	30	4	21	5	22 %
II	VAPOUR COMPRESSION & ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS	15	30	4	21	5	22 %

III	REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION	15	30	4	21	5	22 %
IV	PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS	15	25	2	18	5	17 %
V	COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES	15	25	2	18	5	17 %
	<b>Total</b>	75	<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100 %</b>

#### Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Refrigeration and Air Conditioning	3	3	1	-	3	-	3

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

### Contents: Theory

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS</b></p> <p>Thermodynamic state of a pure substance, modes of heat transfer – laws of heat transfer - mechanisms of production of cold - unit of refrigeration – types of refrigeration - reversed Carnot cycle - C.O.P of heat engine-heat pump- refrigerating machine – principle of working of open and closed air system of refrigeration – advantages and disadvantages – and its application of air cycle-problems</p> <p>Compressor – principle of working and constructional details of reciprocating and rotary compressors, hermetically and semi hermetically sealed compressors- condensers-principle of working and constructional details of air cooled and water cooled condensers, evaporative condensers- advantages and disadvantages - natural and forced draught cooling towers.</p> <p>Evaporators- natural circulation and forced circulation type – principle of working constructional details.</p>	<b>15</b>
<b>II</b>	<p><b>VAPOUR COMPRESSION REFRIGERATION SYSTEM, VAPOUR ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS</b></p> <p>Principle of working of vapour compression system – analysis of vapour compression cycle using T-s diagram and p-H diagram-refrigerating effect- compression work - C.O.P - effect of superheating and under cooling – effect of evaporative pressure and condenser pressure-problems – liquid vapour refrigeration heat exchangers -advantages and disadvantages of superheating and under cooling – use of flash chamber and accumulator.</p> <p>Simple absorption system – Electrolux system - solar absorption refrigeration system- absorption system comparison with mechanical refrigeration system.</p> <p>Refrigerators for above 2 K- Philips Refrigerator--Giffered McMohan refrigerator- refrigerators for below 2 K - Magnetic refrigeration systems.</p>	<b>15</b>
<b>III</b>	<p><b>REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION</b></p> <p>Capillary tube-automatic expansion valve-thermostatic expansion valve-electronic expansion valve-solenoid valve-evaporator pressure regulator –</p>	<b>15</b>

	<p>suction pressure regulator-classification of refrigerants-selection of a refrigerant-properties and applications of following refrigerants <math>\text{SO}_2</math>, <math>\text{CH}_4</math>, <math>\text{F}_{22}</math>, and <math>\text{NH}_3</math> –CFCs refrigerants- equivalent of CFCs refrigerants(R-123a,R-143a,R-69S)-blends of refrigerants(R400 and R500 Series) - lubricants used in refrigeration and their applications.</p> <p>Slow freezing –quick freezing- cold storage-frozen storage-freeze drying – dairy refrigeration –ice cream cabinets-ice making – water cooler, milk cooler, bottle cooler-frost free refrigeration.</p>	
<b>IV</b>	<p><b>PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS</b></p> <p>Psychrometry properties - adiabatic saturation of air by evaporation of water- psychrometric chart and its uses – psychrometric processes – sensible heating and cooling - humidifying and heating - dehumidifying and cooling - adiabatic cooling with humidification - total heating or cooling processes -sensible heat factor - by pass factor – adiabatic mixing – evaporative cooling - problems – governing optimum effective temperature – comfort chart-design consideration.</p> <p>Equipment for air conditioning and insulation factors – air purification – temperature control – humidity control – dry and wet filters- centrifugal dust collector – air washer humidifier – dehumidifier - fans and blowers – grills and registers – summer and winter air conditioning, window and split air conditioners — properties of ideal insulator, types of insulating materials.</p>	<b>15</b>
<b>V</b>	<p><b>COOLING LOAD CALCULATIONS AND DUCT DESIGN , ENERGY CONSERVATION TECHNIQUES</b></p> <p>Different heat sources – conduction heat load – radiation load of sun – occupants load – equipment load - infiltration air load – miscellaneous heat sources –fresh air load - problems.</p> <p>Classification of duct systems - Duct design – equal friction method – velocity reduction method – problems. Chilled water Systems -Air handling Units.</p> <p>Energy conservation and design decisions - heat reclaim – thermal storage – ice builder – ice harvester – variable refrigerant flow (VRF) – variable primary flow (VPF).</p>	<b>15</b>

**Text Books:**

1. Refrigeration and air conditioning, P.L . Ballaney, Khanna Publishers, 2B, North Market, Naisarak, New Delhi 110 006.
2. Refrigeration and air conditioning, V.K. Jain,
3. Industrial Refrigeration Hand Book, Wilbert F. Steocker

**Reference Books:**

1. A course in refrigeration and air conditioning , Domkundwar,
2. Principles of refrigeration, Dossat ,
3. Home refrigeration and air conditioning, Audels, Theo.Audel & Co. publisher, 199 Edn.49, West 23<sup>rd</sup> Street, New York. – 1998
4. Refrigeration and air conditioning, C.P Arora, Cryogenic systems Randell Fd Barron.

## MODEL QUESTION PAPER - I

Term : VI Time : 3 Hours  
Programme : Diploma in Mechanical Engineering Max. Marks : 75  
Course : Elective Theory II - Refrigeration and Air Conditioning  
Code : N1ME406

- [ **N.B:** (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]

### PART – A

1. What do you mean by hermetically sealed compressor?
2. Write down the different types of refrigeration.
3. Name any two refrigerators for above 2 k application.
4. How does a capillary tube work?
5. State any two advantages of central air conditioning system.
6. Represent constant DBT lines and constant RH lines in a psychrometric chart.
7. Define VPF.
8. List out any two of duct systems.

### PART – B

9. How are cooling towers classified?
10. Differentiate open air system with closed air system.
11. What are the effects of superheating?
12. Write the desirable properties of refrigerants.
13. What are Grills and registers?
14. What are the different types of insulating materials used for air-conditioned building?
15. State any three resources of latent heat load.
16. List out the components of AHU.

[Turn over .....

- 2 -  
**PART – C**

17 (a) Explain with the neat sketch about the natural circulation and forced circulation evaporators..

(Or)

(b) A perfect reversed heat engine is used for making ice at 0°C from water available at 20°C. The temperature of the brine or freezing mixture is -10°C. Find the amount of ice produced per KW hr. Take latent heat of ice as 336 KJ/kg.

18. (a). Explain the working of vapour absorption system with neat sketch..

(Or)

(b). A vapour compression refrigerator works between the pressure limits of 60 bar and 25 bar. The working fluid is just dry at the end of compression and there is no under cooling of the Liquid before the expansion valve. Determine (i) COP of the cycle (ii) capacity of the refrigerator if the flow at the rate of 10 kg/min.

Pressure (bar)	Saturation temperature (°C)	Enthalpy(kJ/kg)		Entropy (KJ/kg k)	
		Liquid	vapour	Liquid	vapour
60	22	151.96	293.29	0.554	1.0332
25	-12	56.32	322.58	0.226	1.2464

19 (a) Explain the working principle of solenoid valve with neat sketch and briefly explain about milk cooler.

(Or)

(b) i) State five desirable properties of a good lubricating oil.  
ii) Give the properties and applications of ammonia as a refrigerant.

20 (a) Explain the working of summer air conditioning system with a neat sketch.

(Or)

(b) Air at atmosphere pressure and DBT and WBT of 25°C and 15°C respectively enters a heating coil whose temperature is 35°C. The by-pass factor of the heating coil is 0.25. Determine DBT, WBT, RH of air leaving the heating coil. Also find the sensible heat added to air per kg of dry air.

21 (a) Discuss the various types of duct systems and their applications.

(Or)

(b) Explain variable Refrigerant flow (VRF) system with neat sketch.

## MODEL QUESTION PAPER - II

Term : VI Time : 3 Hours  
Programme : Diploma in Mechanical Engineering Max. Marks: 75  
Course : Elective Theory II Code: N1ME406  
Refrigeration and Air Conditioning

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What are the modes of heat transfer?
2. Classify condensers.
3. Define refrigerating effect.
4. What are the three fluids used in Electrolux refrigeration system?
5. Write the function of automatic expansion valve.
6. What is frozen storage?
7. State the use of psychrometric chart.
8. Define occupants load.

### PART – B

9. What are the Advantages and applications of air-refrigeration system?
10. Explain forced draft cooling towers.
11. Write short notes on effect of suction and discharge pressure.
12. Compare Vapour Compression and Vapour absorption system.
13. Explain suction pressure regulator.
14. Write short notes on air blast freezing.
15. Describe about sensible heat factor.
16. Explain chilled water system.

[ Turn over .....

**PART – C**

17. (a) 1.5 KW per tonne of refrigeration is required to maintain the temperature of  $-40^{\circ}\text{C}$  in the refrigerator. If the refrigeration cycle works on Carnot cycle, determine the followings, i. C.O.P. of the cycle. ii. Temperature of the sink. iii. Heat rejected to the sink per tonne. iv. Heat supplied used as heat pump.

(Or)

- (b) Explain the construction and working of evaporative condensers.

18. (a) Draw and explain in detail the working of vapour compression refrigeration system.

(Or)

- (b) Explain in detail the working of Giffered McMohan refrigerators.

19. (a) Explain with a neat sketch of automatic expansion valve.

(Or)

- (b) Explain with a neat sketch of ice making plant.

20. (a) Moist air enters a refrigeration coil at  $35^{\circ}\text{C}$  dry bulb temperature and 55% RH at the rate of  $100\text{m}^3/\text{min}$ . The barometric pressure is 1.013 bar. The air leaves at  $27^{\circ}\text{C}$ . Calculate the tonnes of refrigeration required and the final RH.

(Or)

- (b) Explain with a neat sketch of summer air-conditioning.

21. (a) A small office room of 25 persons working is provided with summer air conditioning system with the following observations.

Outside conditions =  $34^{\circ}\text{C}$  DBT and  $28^{\circ}\text{C}$  WBT.

Inside conditions =  $24^{\circ}\text{C}$  DBT and 50% RH.

Volume of air supplied =  $0.4\text{m}^3/\text{min}/\text{person}$

Sensible heat load = 125600 kJ/hour

Latent heat load = 42000 kJ/hour

Find the sensible heat factor of the office room.

(Or)

- (b) Explain about the variable refrigerant flow and variable primary flow.

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**N1 – SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1CO400**  
**Term : VI**  
**Course Name : ELECTIVE THEORY II - NANO AND SOLAR ENGINEERING**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Nano and Solar Engineering	5	75	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topics	Hours
I	BASICS OF NANO SCIENCE AND CLASSES OF NANO SCIENCE	15
II	SYNTHESIS, CHARACTERIZATION & APPLICATION OF NANO MATERIAL	15
III	FUNDAMENTALS OF SOLAR CELL AND ITS PERFORMANCE	15
IV	SOLAR CELL CLASSIFICATIONS AND ITS COMPONENTS	15
V	TYPES OF SOLAR SYSTEM AND DESIGN OF SOLAR HOME SYSTEM	15
	<b>TOTAL</b>	<b>75</b>

**Course Outcomes:**

On successful completion of the course, the student will be able to:

<b>C400.1</b>	<b>Understand the basics of Nano technology - properties, behavior and materials</b>
<b>C400.2</b>	<b>Acquire knowledge about synthesis, characterization and applications of Nano material</b>
<b>C400.3</b>	<b>Study about renewable energy sources and understand the basic principle of solar energy conversion</b>
<b>C400.4</b>	<b>Acquire knowledge about the various components of solar cell</b>
<b>C400.5</b>	<b>Able to classify solar system and to design a solar Home system</b>

**Course Outcome Linkage to Cognitive level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		CL	Linked PO,PSO	Teaching Hrs
<b>C400.1</b>	<b>Understand the basics of Nano technology - properties, behavior and materials</b>	R/U/A	PO1,PSO2	15
<b>C400.2</b>	<b>Acquire knowledge about synthesis, characterization and applications of Nano material</b>	R/U/A	PO1,PO2,PO4,PSO2	15
<b>C400.3</b>	<b>Study about renewable energy sources and understand the basic principle of solar energy conversion</b>	R/U/A	PO1,PO5,PSO2	15
<b>C400.4</b>	<b>Acquire knowledge about the various components of solar cell</b>	R/U/A	PO1,PSO2	15
<b>C400.5</b>	<b>Able to classify solar system and to design a solar Home system</b>	R/U/A	PO1,PO3,PO4,PO7, PSO2	15
<b>Total sessions</b>				<b>75</b>

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	BASICS OF NANO SCIENCE AND CLASSES OF NANO SCIENCE	15	25	2	18	5	17.86 %
II	SYNTHESIS, CHARACTERIZATION & APPLICATION OF NANO MATERIAL	15	25	2	18	5	17.86 %
III	FUNDAMENTALS OF SOLAR CELL AND ITS PERFORMANCE	15	25	2	18	5	17.86 %
IV	SOLAR CELL CLASSIFICATIONS AND ITS COMPONENTS	15	25	2	18	5	17.86 %
V	TYPES OF SOLAR SYSTEM AND DESIGN OF SOLAR HOME SYSTEM	15	25	2	18	5	17.86 %
I to V*			15	6	9	0	10.70 %
<b>Total</b>		<b>75</b>	<b>140</b>	<b>16</b>	<b>99</b>	<b>25</b>	<b>100 %</b>

\* 3 x 2Marks and 3 x 3Marks from any Unit limited to maximum of 2 Questions in each unit

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Nano and Solar Engineering	3	2	3	3	2	-	1

**Course-PSO Attainment Matrix:**

Course Name	Programme Specific Outcomes	
	1	2
Nano and Solar Engineering	-	3

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**N1CO400 – NANO AND SOLAR ENGINEERING**  
**DETAILED SYLLABUS**

**Contents: Theory**

Unit	Name of the Topics	Hours
<b>I</b>	<p><b>BASICS OF NANO SCIENCE AND CLASSES OF NANO SCIENCE</b></p> <p>Nano technology – Difference between bulk and Nano scale materials – Properties at the Nano scale –Size dependent behavior.</p> <p>Quantum dots – Nano wells – Nano films and Nano wires – Bucky balls – Carbon Nano tubes – Single walled and Multi walled CNT.</p>	<b>15</b>
<b>II</b>	<p><b>SYNTHESIS, CHARACTERIZATION AND APPLICATION OF NANO MATERIAL</b></p> <p>Top-Down approach – Nanolithography – Ball Milling - Bottom-Up approach – CVD (Chemical Vapor Deposition). Sol-gel processing – Spin Coating Method, Dip Coating Method.</p> <p>Characterization of Nano Particles - SEM –XRD – UV Spectroscopy, PV Characteristics of Nano Thin Films using 4 probe methods.</p> <p>Hydrophobic nature of Nano Thin films. Application of Nano Technology - Electronics – Textiles – Solar technology – Construction Materials –Nano Technology in medical science – Drug Delivery system for Cancer Treatment.</p>	<b>15</b>
<b>III</b>	<p><b>FUNDAMENTALS OF SOLAR CELL AND ITS PERFORMANCE</b></p> <p><b>Energy Resources:</b> Renewable energy sources scenario in India – Importance of renewable energy sources-Wind energy-Solar energy-Advantages of solar energy - Physics of the Sun - Solar spectrum - green house effect</p> <p><b>Concepts:</b> Photovoltaic effect - Principle of direct solar energy conversion into electricity in a solar cell -Solar cell, p-n junction – structure - I-V characteristics - effect of irradiation and temperature - fill factor - maximum power point – losses - cell efficiency</p>	<b>15</b>

<b>IV</b>	<p><b>SOLAR CELL CLASSIFICATIONS AND ITS COMPONENTS</b></p> <p>Types of Solar cells - Solar Modules - Blocking Diode - By-pass Diode - Solar Array - Isolation Diode –</p> <p><b>Batteries in Solar PV Systems:</b> Battery Types and Classifications, Construction of Lead – Acid battery, Lead-Acid Battery Chemistry, Modern Rechargeable Batteries, Methods of Battery Charging</p> <p><b>Charge controllers:</b> Shunt regulator, Series regulator, Methods of Charging the Battery by CR. <b>Inverters:</b> Basic Principle of operation, Types of Inverters.</p>	<b>15</b>
<b>V</b>	<p><b>TYPES OF SOLAR SYSTEM AND DESIGN OF SOLAR HOME SYSTEM</b></p> <p><b>Classification:</b> Stand alone PV system - Grid connected PV System - Hybrid solar PVsystem</p> <p><b>Design of Solar Home System (SHS) -</b> Selection of Solar PV module - Selection of Battery - Selection of Charge Controller - Selection of DC/AC Inverter - Selection of DC/DC converter - Selection of switch - Selection of the wire size for solar home system</p>	<b>15</b>

**Text Books:**

1. “Nano Technology” – N.Arumugam, SaraS Publication.
2. Pradeep.T, Fundamentals of Nanoscience and Nanotechnology, Mc GrawHill,2012.
3. Sukhatme .S.P, Nayak .J.K, “Solar Energy”, Tata McGraw Hill Education Private Limited, New Delhi, 2010.
4. Unit III to Unit V *Training Manual For Engineers on Solar PV System* published by Government of Nepal, Ministry of Environment, Science and Technology.
- 5.Solar photovoltaic systems technical training manual by Herbert A Wade UNESCO publishing.

**Reference Books:**

1. C.P.Poole, Jr. Frank J.Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital PublishingCompany).
3. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience & Technology (PHI Learning Private Limited).
4. Chetan Singh Solanki., *Solar Photovoltaic: “Fundamentals, Technologies and Application”*, PHI Learning Pvt., Ltd., 2009.
6. John R. Balfour, Michael L. Shaw, Sharlave Jarosek., “*Introduction to Photovoltaics*”, Jones & Bartlett Publishers, Burlington, 2011.

## MODEL QUESTION PAPER - I

Term : VI Time : 3 Hours  
Programme : Diploma in Mechanical Engineering Max. Marks: 75  
Course : Elective Theory II - Nano and Solar Engineering Code : N1CO400

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What is Nano technology?
2. Write notes on fullerene.
3. What is top down approach?
4. What is SEM?
5. What is a renewable energy source?
6. What is photo voltaic effect?
7. Name the types of inverter.
8. What is a Hybrid PV system?

### PART – B

9. Explain about nano wires.
10. Briefly explain spin coating method.
11. Write the applications of nano technology in medicine.
12. Explain I-V characteristics of PV cells
13. Write the advantages of solar energy.
14. Explain Blocking diode with block diagram.
15. Explain with Block diagram Stand alone PV System.
16. What are the factors to be consider while design a stand alone PV system?

**[Turn over .....**

- 2 -  
**PART – C**

17. (a). i. Discuss the difference between nano and bulk materials.  
ii. Write short notes on size dependant behavior of nano materials.

*(Or)*

(b). Explain Single walled and multi walled CNT.

18. (a). What is Top down approach? Explain any one method with neat sketch.

*(Or)*

(b). Explain about SEM with block diagram.

19. (a). Draw the different types of wind turbines and explain. Write the advantages and disadvantages of wind energy.

*(Or)*

(b). Explain the process of converting Solar energy into electric energy in a PV cell.

20. (a). Explain about the construction of a Lead acid battery.

*(Or)*

(b). Explain the various methods of charging a battery by CR.

21. (a). Explain with block diagram the Working of Grid connected PV system.

*(Or)*

(b). Explain the design procedure for Solar Home system.

## MODEL QUESTION PAPER - II

Term : VI Time : 3 Hours  
Programme : Diploma in Mechanical Engineering Max. Marks : 75  
Course : Elective Theory II - Nano and Solar Engineering Code : N1CO400

**[ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART – A

1. What is Nano material?
2. Write notes on bucky ball.
3. What is bottom up approach?
4. What is XRD?
5. What is a non renewable energy source?
6. What is about Voc in solar cell.
7. What is secondary cell?
8. What is a standalone PV system?

### PART – B

9. Define Fullerene.
10. Define CNT.
11. What is CVD process?
12. Write the applications of nano technology.
13. Write the advantages of Wind energy.
14. Draw the IV characteristics of solar cell.
15. What is Bypass diode?
16. Write the formula for finding solar panel capacity.

**[Turn over .....**

- 2 -  
**PART – C**

17. (a). i. Discuss the difference between nano and bulk materials.  
ii. Write short notes on Quantum dots.

(Or)

(b). Explain in detail about Carbon Nano Tube and its types.

18. (a). What is Bottom Up approach? Explain any one method with neat sketch.  
(Or)

(b). Explain about the applications of nano technology.

19. (a). Draw and explain the different types of wind turbines.  
(Or)

(b). Explain about P-N Junction in detail.

20. (a). Explain about Blocking diode and Bypass diode in detail.  
(Or)

(b). Explain the basic principle of operation of inverters.

21. (a). Explain briefly about the types of solar PV system.  
(Or)

(b). Design a Solar home system for the given AC load profile

Load profile of the SHS user

Particular	Quantity	Power (Watt)	Daily operation (Hours)	Remarks
Electric lamp	1	10	3	Living room
Electric lamp	1	7	3	Kitchen
Total		17		

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**N1 - SCHEME**

**Programme : Diploma in Electrical and Electronics Engineering**

**Course code : N1CO402**

**Term : VI**

**Course Name: Elective Theory – II ELECTRIC VEHICLE**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
<b>Elective Theory - II ELECTRIC VEHICLE</b>	5	75	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Topics and Allocation of Hours:**

UNIT	Topics	Hours
I	Introduction to Electric Vehicle and Hybrid Electric Vehicle	15
II	Dynamics of Electric and Hybrid Vehicles	15
III	Energy Storage Devices	15
IV	Electric Drives and Control	15
V	Power electronic converters for electric vehicle	15
	<b>Total</b>	75

**Course Outcomes:**

On completion of these units, the student should be able to:

C 402.1	Study the scope and configuration of Electric and Hybrid Vehicles
C 402.2	Understand the dynamics of Electric vehicle and Hybrid Vehicle
C 402.3	Study the functions of various energy storage devices
C 402.4	Understand the DC and AC Motor drives and control for Electric Vehicle
C 402.5	Study the Power converters suitable for Electric Vehicle

**Cognitive Level Legend: R – Remember, U – Understand, A – Application**

Course Outcome		CL	Linked PO	Teaching Hrs
C 402.1	Study the scope and configuration of Electric and Hybrid Vehicles	R/U	PO1,PO5,PSO2	15
C 402.2	Understand the dynamics of Electric vehicle and Hybrid Vehicle	R/U	PO2,PO3,PSO2	15
C 402.3	Study the functions of various energy storage devices	R/U	PO1,PO2,PO3,PSO2	15
C 402.4	Understand the DC and AC Motor drives and control for Electric Vehicle	U/A	PO1,PO2,PO3,PSO2	15
C 402.5	Study the Power converters suitable for Electric Vehicle	U/A	PO3,PO4,PO7,PSO2	15
			<b>Total sessions</b>	<b>75</b>

**Course Content and Blue Print of Marks for End Examination:**

Unit No	Unit Name	Hours	Max. Marks	Questions to be set for			Marks weightage (%)
				R	U	A	
I	Introduction to Electric Vehicle and Hybrid Electric Vehicle	15	25	2	18	5	17.86 %
II	Dynamics of Electric and Hybrid Vehicles	15	25	2	18	5	17.86 %
III	Energy Storage Devices	15	25	2	18	5	17.86 %
IV	Electric Drives and Control	15	25	2	13	10	17.86 %
V	Power electronic converters for electric vehicle	15	25	2	13	10	17.86 %
I to V*			15	6	9	0	10.70 %
<b>Total</b>			<b>140</b>	<b>16</b>	<b>89</b>	<b>35</b>	<b>100 %</b>

**\*3x2 Marks and 3x3 Marks from any Unit limited to maximum of 2 Questions in each unit**

**Course – PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Elective Theory – II <b>ELECTRIC VEHICLE</b>	2	2	2	1	1	-	1

**Course – PSO Attainment Matrix:**

Course Name	Programme Specific Outcomes	
	1	2
Elective Theory – II <b>ELECTRIC VEHICLE</b>		3

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

**DETAILED SYLLABUS****Contents: Theory**

Unit	Name of the Topic	Hours
<b>I</b>	<b>INTRODUCTION TO ELECTRIC VEHICLE AND HYBRID ELECTRIC VEHICLE</b> Introduction to Electric Vehicles: History of Electric Vehicles(EV) and Hybrid Electric Vehicles(HEV)–Compare IC Engine Vehicle with EV - Social and environmental importance of EV and HEV – Well-to-Wheels Efficiency- Configuration of EV and HEV –EV and HEV Drive-train topologies - Series Hybrid Electric Drive Trains - Parallel hybrid electric drive trains.	<b>15</b>
<b>II</b>	<b>DYNAMICS OF ELECTRIC AND HYBRID VEHICLES</b> Introduction – General description of Vehicle movement – Rolling resistance – Aerodynamic drag – Grading resistance – Acceleration Resistance – Total driving resistance – Dynamic equation – Adhesion, Dynamic wheel radius and slip – Drive train tractive effort and vehicle speed. Vehicle performance – Maximum cruising speed – Grade ability – Acceleration performance	<b>15</b>

<b>III</b>	<p><b>ENERGY STORAGE DEVICES</b></p> <p>Introduction – Over view of batteries – Battery parameters –Capacity – C rating – State of Charge – Depth of Discharge – State of Health – Type of Battery and its Technical characteristics- Lead acid battery, Lithium batteries, Metal air batteries - Battery pack Design, Properties of Batteries,- battery Swapping</p> <p>Alternative Energy Sources- Fuel Cell, Super Capacitor - Hybridization of different energy storage devices</p>	<b>15</b>
<b>IV</b>	<p><b>ELECTRIC DRIVES AND CONTROL</b></p> <p>Introduction to Electric Drives - DC motor drives - Induction motor drives - Permanent Magnet Motor Drives- Sinusoidal back EMF(BLAC), Trapezoidal back EMF(BLDC) , Switch Reluctance Motor Drive for Electric Vehicles, Configuration and Speed control of Drives.</p>	<b>15</b>
<b>V</b>	<p><b>POWER ELECTRONIC CONVERTERS FOR ELECTRIC VEHICLE</b></p> <p>Introduction – Classification of DC/DC Converter - Buck, Boost and Buck Boost Converter –Multi input DC/DC Converter – DC-AC Inverter– Battery Charger- Slow , fast, Rapid Chargers</p>	<b>15</b>

**Text Book:**

Sl.No	Name of the Book	Author	Publisher
1.	Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design	M. Ehsani	CRC Press, 2005

**Reference Books:**

Sl.No	Name of the Book	Author	Publisher
1	Hybrid Vehicles and the Future of Personal Transportation	E. Fuhs	CRC Press, 2009
2	Power Electronics: Circuits, Devices and Applications	M. H. Rashid	3 <sup>rd</sup> edition, Pearson, 2004
3	Power Electronics: Devices, Circuits and Industrial Applications	V. R. Moorthi	Oxford University Press, 2007

## MODEL QUESTION PAPER - I

Term : VI

Time : 3hrs

Programme: Diploma in Electrical and Electronics Engineering

Max. Mark: 75

Course : Elective Theory – II: ELECTRIC VEHICLE Course Code : N1CO402

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C. ]**

### PART-A

1. What is Hybrid Electric Vehicle?
2. Define the term “Aerodynamic drag”.
3. Define Specific energy of battery.
4. What are the disadvantages of Permanent Magnet machines?
5. What is duty cycle?
6. What are the economic parameters which characterize Vehicles?
7. Define Acceleration resistance.
8. What are the properties of battery?

### PART B

9. What is the various configuration of Hybrid Electric Vehicle?
10. List the factors to which the acceleration depends upon.
11. What are types of batteries used in EV?
12. What are the motors used for Electric vehicle?
13. How converters are classified?
14. What are the requirements of Electric Motors used in EVs?
15. Draw the waveform of Trapezoidal back emf.
16. Write the expression for Average output voltage, Average load current of step down operation

*[Turn Over-----*

**PART C**

17. (a) With a suitable block diagram explain the general configuration of EV?  
(OR)  
(b) With a block diagram explain the detailed configuration of Series Hybrid Vehicle.
18. (a) Explain the various forces acting on a vehicle going uphill.  
(OR)  
(b) With an expression explain the drive train tractive effort and vehicle speed.
19. (a) Explain with chemical reaction the operation of Lead Acid battery  
(OR)  
(b) Explain the battery charging and charge equalization.
20. (a) Explain the principle of operation of Permanent Magnet Machine.  
(OR)  
(b) Explain the Switch Reluctance Motor drive for EV?
21. (a) Explain the operation of Buck – Boost Converter Circuit.  
(OR)  
(b) Explain the Single Phase bridge DC – AC Inverter circuit

**MODEL QUESTION PAPER - II**

Term : VI

Time : 3hrs

Programme: Diploma in Electrical and Electronics Engineering

Max. Mark : 75

Course : Elective Theory – II: ELECTRIC VEHICLE Course Code : N1CO402

- [ N.B: (1) Answer any FIVE Questions in each PART – A and PART – B.  
Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory.  
(2) Answer division (a) or division (b) of each question in PART – C.  
(3) Each question carries 2 Marks in PART – A, 3 Marks in PART – B  
and 10 Marks in PART – C.**

**PART-A**

1. What are the types of Electric Vehicle?
2. What are the causes for Rolling resistance?
3. Define the term “State of Charge” of a battery
4. What are the classifications of PM Machines based on rotor construction?
5. What you mean by Buck Converter?
6. What are the major components of ICE Vehicle which causes air pollution?
7. What are the advantages of permanent magnet synchronous machine?
8. Draw the VI Characteristics for First and Second quadrant operations

**PART B**

9. Compare IC Engine Vehicle with EV?
10. What is grading resistance? Give the expression.
11. Draw the equivalent circuit of a battery
12. What are the advantages of BLDC Motor?
13. Draw the diagram of Boost Converter.
14. What are the various types of HEV?
15. Why should the No. of poles of stator be equal to No. of poles on rotor?
16. What is multi input Converter? Give an example.

**[Turn Over---**

**PART C**

- 17 (a) Explain the different drive train alternatives based on its configuration.  
(OR)  
(b) With a block diagram explain the complex hybrid system.
18. (a) Explain the factors which govern the vehicle performance  
(OR)  
(b) Derive the dynamic equation of Vehicle motion
19. (a) Explain the operation of Lithium ion battery  
(OR)  
(b) Explain the basic principle of Hydrogen fuel cell
20. (a) Explain the operation of PM supplied by DC-AC Converter with  $120^\circ$  mode of Operation.  
(OR)  
(b) Explain any one method of Speed Control of AC drive.
- 21.(a) Explain the operation of four quadrant operation of DC – DC Converter  
(OR)  
(b) Explain the Three Phase DC – AC Inverter circuit

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1ME318**  
**Term : VI**  
**Course Name : COMPUTER AIDED MANUFACTURING PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Computer Aided Manufacturing Practical	6	90	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C318.1</b>	Study the working principle, datum setting and offset of CNC machines.
<b>C318.2</b>	Write program and simulate it in the Lathe software and Produce components in the CNC Turning center.
<b>C318.3</b>	Write program and simulate it in the Milling software and Produce components in the CNC Machining center.

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO	Teaching Hrs
<b>C318.1</b>	Study the working principle, datum setting and offset of CNC machines.	<b>1,2,3,4,5,6,7</b>	R/U	PO1, PO2, PO4, PSO1	12
<b>C318.2</b>	Write program and simulate it in the Lathe software and Produce components in the CNC Turning center	<b>1,2,3,4</b>	R/U/A	PO1, PO2, PO4, PO7, PSO1	39
<b>C318.3</b>	Write program and simulate it in the Milling software and Produce components in the CNC Machining center.	<b>5,6,7</b>	R/U/A	PO1, PO2, PO4, PO7, PSO1	39

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Computer Aided Manufacturing Practical	<b>3</b>	<b>3</b>	-	<b>3</b>	-	-	<b>2</b>

**Course-PSO Attainment Matrix:**

Course Name	Programme Specific Outcomes	
	1	2
Computer Aided Manufacturing Practical	<b>3</b>	-

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

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## LIST OF EXERCISES

### CNC Programming, Simulation and Machining (90 Hrs.)

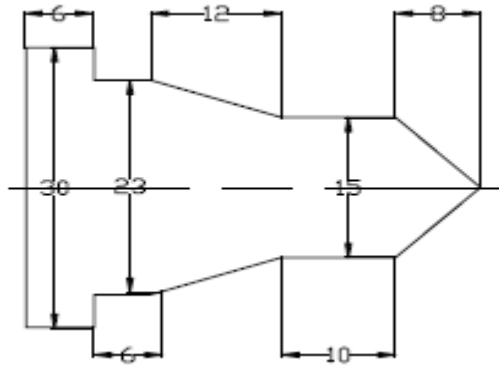
#### **Introduction:**

Study of CNC lathe, milling - Study of international standard codes: G-Codes and M-Codes - Format – Dimensioning methods. -Program writing –Turning simulator Milling simulator, IS practice – commands menus - Editing the program in the CNC machines.-Execute the program in the CNC machines.

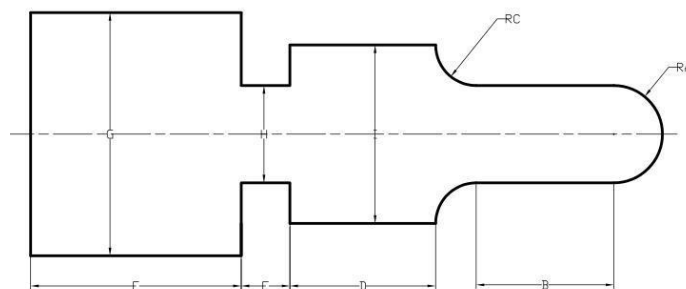
#### **CNC Turning Machine**

**Material:** M.S / Aluminum / acrylic fibre / plastic

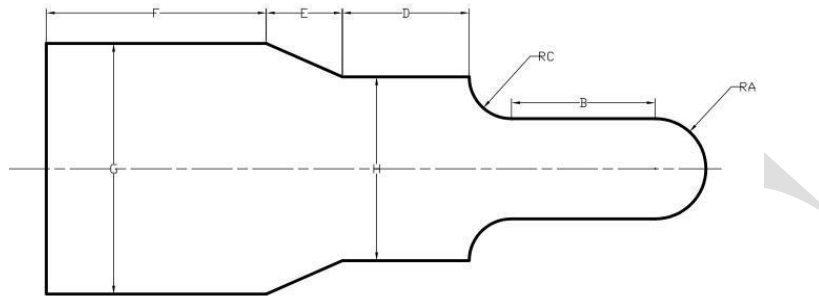
1. Using Box turning cycle -Create a part program for taper turning and simulate in the software and also produce component



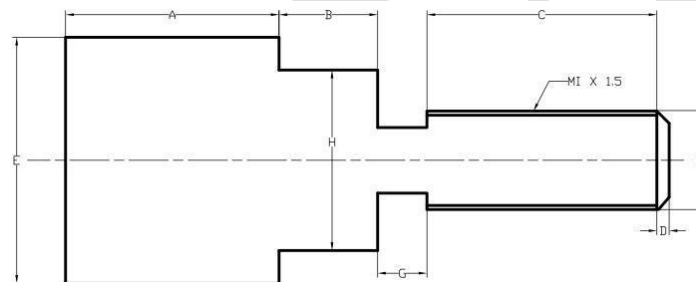
2. Using Linear and Circular interpolation - Create a part program for Linear and Circular interpolation and simulate in the software and also produce component



3. Using Stock removal cycle – Create a part program for multiple turning operations and simulate in the software and also produce component



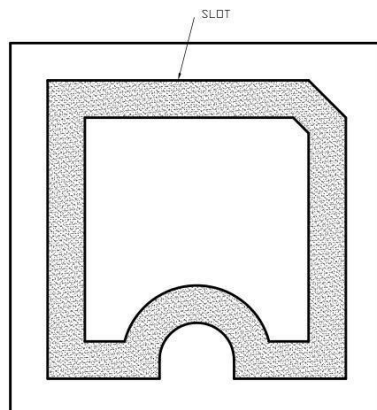
4. Using thread cutting cycle - Create a part program for thread cutting, grooving and simulate in the software and also produce component



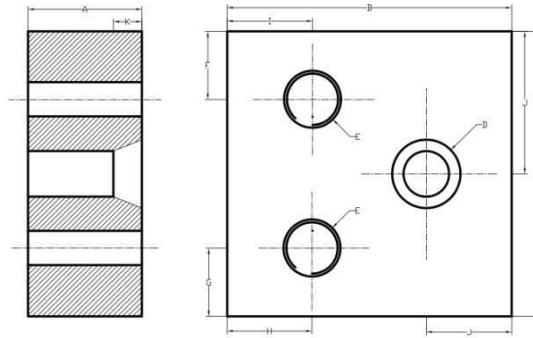
**CNC Milling Machine**

**Material:** M.S / Aluminum / acrylic fibre / plastic

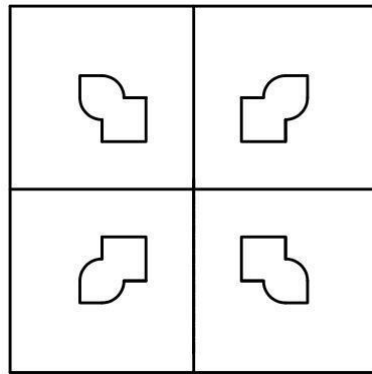
5. Using Linear and Circular interpolation – Create a part program for grooving and simulate in the software and also produce component



6. Using canned cycle - Create a part program for drilling, tapping, counter sinking and simulate in the software and also produce component



7. Using subprogram - Create a part program for Mirroring and simulate in the software and also produce component



**3D Printing**

**Material:** PLA (POLY LACTIC ACID)

Create a part by using Modeling Software (Solid works / PRO-E /Auto-CAD and etc) and produce the component in 3D printing machine.

- 8. V-Block
- 9. Geneva wheel
- 10. Cup of screw jack

**Note:** Print the part program and simulation / CAD model and also make the component in the CNC machine / 3D printing machine.

**Reference Book:**

CNC Programming & Operations, Sankar, Sathish and Balamurugan – Micro Publications, Trichy

**LIST OF EQUIPMENTS**

1.	Personal computer	- 30 Nos.
2.	CNC programming software (Lathe and Milling)	- Sufficient to the strength.
3.	Modeling package	- Sufficient to the strength.
	(Solid works / Pro-E / Catia / Unigraphics / AutoCAD etc...)	
4.	CNC Turning Machine	- 1 No.
5.	CNC Milling Machine	- 1 No.
6	3D Printing machine	- 1 No.
7.	Laser Printer	- 1 No.
8.	Consumables	- Sufficient quantity.

## END EXAMINATION

**Note: All exercises should be completed. Any exercise should be carried out by selecting the exercise in CNC machine or 3D printing. The printouts must be kept along with the examination paper.**

### Detailed Allocation of Marks for External Assessment

Program writing / create a solid model with print out	: 30
Simulation (printout ) / Import the model to 3D printer	: 20
Produce the component	: 20
<b>Viva voce</b>	<b>: 05</b>
<b>Total</b>	<b>: 75</b>

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course Code : N1ME319**

**Term : VI**

**Course Name : MACHINE TOOL TESTING, MAINTENANCE AND  
INSTRUMENTATION PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Machine Tool Testing, Maintenance and Instrumentation Practical	4	60	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

C319.1	Setup instrument for machine tool testing
C319.2	Observe the machine tool alignment and results
C319.3	Observe the manufacturing accuracy of machine tools
C319.4	Acquire knowledge of maintenance and trouble shooting of Machines and its components
C319.5	Ability to measure Displacement, Temperature, Force using sensors & perform calibration

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO	Teaching Hrs
C319.1	Setup instrument for machine tool testing	1,2,3	U,A	PO1,PO3,PO4	12
C319.2	Observe the machine tool alignment and results	1,2,3	U,A	PO1,PO3,PO4	12
C319.3	Observe the manufacturing accuracy of machine tools	1,2,3	U,A	PO1,PO3,PO4	12
C319.4	Acquire knowledge of maintenance and trouble shooting of Machines and its components	7	U,A	PO1,PO3	12
C319.5	Ability to measure Displacement, Temperature, Force using sensors & perform calibration	4,5,6	U,A	PO1,PO3	12

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Machine Tool Testing, Maintenance and Instrumentation Practical	3	-	3	3	-	-	-

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

- If  $\geq 40\%$  of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
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## LIST OF EXERCISES

### Part A: Machine Tool Alignment

1. Conduct the following test for the lathe machine and prepare a test chart.
  - Check the level of slide ways.
  - Check the straightness of carriage movement.
  - Check the parallelism of tailstock movement to carriage movements.
  - Check the run-out of the spindle.
  - Check the parallelism of the axis of the outside of tailstock sleeve to carriage movement.
2. Conduct the following test for the surface grinding machine and prepare a test chart.
  - Verify the leveling of slide ways.
  - Verify the straightness of slide ways in a horizontal plane.
  - Verify the flatness of the table surface.
  - Verify the parallelism of the table surface.
  - Check the run-out of the wheel spindle nose.
3. Conduct the following test for the milling machine and prepare a test chart.
  - Check the straightness of the vertical movement of the knee.
  - Check the squareness of the table surface to the column ways for knee.
  - Check the flatness of the table surface.
  - Check the parallelism of the table surface to its movement.
  - Check the run-out of the internal taper of the spindle.
4. Measure displacement by using inductive transducer. (Linear variable displacement transducer i.e. LVDT) and verify its characteristics.
5. Measure temperature by thermocouple and verifying by thermometer.
6. Measure force or weight by load cell.

### Part B: Maintenance

7. Dismantle, inspect and assemble the following machine components.
  - a) Lead screw and nut
  - b) Tailstock
  - c) Bench vice
  - d) Three jaw chuck
  - e) Four jaw chuck
  - f) Drill chuck

## LIST OF EQUIPMENTS

### Machine

1. Lathe machine - 1 No.
2. Surface grinding machine - 1 No.
3. Milling machine - 1 No.

### Tools

4. Dial gauge - 5 Nos.
5. Magnetic stand - 5 Nos.
6. Surface gauges - 5 Nos.
7. Spirit level - 5 Nos.
8. Spanners (DE/Ring/Box) - Sufficient quantity
9. Screw drivers - Sufficient quantity
10. Allen screw sets - Sufficient quantity
11. Hammer - Sufficient quantity
12. Test mandrels - Sufficient quantity
13. Squares / Blocks - Sufficient quantity

### Machine components

14. Lead screw and nut - 1 No.
15. Tailstock - 1 No.
16. Bench vice - 1 No.
17. Three jaw chuck - 1 No.
18. Four jaw chuck - 1 No.
19. Drill chuck - 1 No.
20. Displacement measuring using LVDT - 1 No
21. Thermocouple and measurement setup - 1 No
22. Load Cell Instruments and Measurement setup - 1 No

## END EXAMINATION

**Note: Examinations will be conducted in both Part A and Part B. Students should be given exercises by selecting one exercise from each part by lot. All the exercises should be given in the question paper and students are allowed to select by a lot.**

### Detailed Allocation of Marks for External Assessment

<b>Machine Tool Alignment &amp; Instruments</b>	<b>45</b>
Procedure / Drawing	15
Geometrical test	20
Result & Test Chart	10
<b>Maintenance</b>	<b>25</b>
Dismantling	10
Trouble shooting procedure	10
Assembling / Report	5
<b>Viva-voce</b>	<b>5</b>
<b>TOTAL</b>	<b>75</b>

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1ME407**  
**Term : VI**  
**Name : ELECTIVE PRACTICAL II**  
**MECHANICAL INSTRUMENTATION PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Mechanical Instrumentation Practical	4	60	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 hours
			25	75	100	

*On successful completion of the course, the student will be able to:*

<b>C407.1</b>	Obtain knowledge on Measurement, Measuring Instrument and Measurement Error. Impart knowledge on Displacement and Pressure Measurement
<b>C407.2</b>	Acquire knowledge on Temperature and Flow Measurement.
<b>C407.3</b>	Gain knowledge on Sound measurement, Humidity measurement, Force & power measurement, Speed Measurement & strain Measurement.
<b>C407.4</b>	Understand Control Systems and its types
<b>C407.5</b>	Setup instrument for machine tool testing.

## Course outcomes linkage to Cognitive level:

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO, PSO	Teaching Hrs
<b>C407.1</b>	Obtain knowledge on Measurement, Measuring	1,2,3,8,9	U/A	PO1, PO3	12
<b>C407.2</b>	Acquire knowledge on Temperature and Flow	4,5,6,7,10,11	U/A	PO1, PO3	12
<b>C407.3</b>	Gain knowledge on Sound measurement, Humidity	12,13	U/A	PO1, PO3	12
<b>C407.4</b>	Understand Control Systems and its types	14	U/A	PO1, PO3	12
<b>C407.5</b>	Setup instrument for machine tool testing.	15,16	U/A	PO1, PO3,PO7	12

## Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
MECHANICAL INSTRUMENTATION PRACTICAL	3		3				1

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

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- If  $< 5\%$  of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## **LIST OF EXERCISES:**

1. Find the static characteristics of instruments with demonstration of any one measuring instrument.
2. Measure displacement by using inductive transducer. (Linear variable displacement transducer i.e. LVDT) and verify its characteristics.
3. Measure negative pressure or vacuum using McLeod gauge / Bourdon tube pressure gauge.
4. Measure temperature by thermocouple and verifying by thermometer.
5. Measure flow of liquid by Rota meter.
6. Measure liquid level by capacitive transducer system.
7. Measure speed of rotating shaft by stroboscope / magnetic / inductive pick up.
8. Measure force or weight by load cell.
9. Measure strain by using basic strain gauge and verify the stress induced.
10. Measurement of Torque

## **LIST OF EQUIPMENTS**

1. Thermometer	2 nos
2. Temperature gauge / Temperature transducer	2 nos
3. Pressure measuring setup using McLeod gauge / Bourdon tube pressure gauge.	2 nos
4. Strain measurement module using Strain gauge	2 nos
5. Displacement measurement module using LVDT	2 nos
6. 3 wire RTD (PT-50 / PT-100) with industrial standard	2 nos
7. Thermocouple (J-type / K-type) with industrial standard	2 nos
8. Water bath with heater arrangement	3 nos
9. Furnace with blower arrangement	1 no
10. Load cell instruments and measurement setup	2 nos
11. Torsion meter/strain gauge torque transducers	2 nos

12. Capacitance transducers, water level trainer kit	2 nos
13. Multi meter	2 nos
14. DC Motor, photoelectric pick up kit, CRO connecting	2 nos
15. Stroboscope	2 nos

### END EXAMINATION

**Note:** All the exercises should be given and students are allowed to select an exercise by lot.

### Detailed Allocation of Marks for External Assessment

Block Diagram	15
Reading and graph	35
Execution of circuit	20
Viva voce	5
<b>TOTAL</b>	<b>75</b>

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1ME408**  
**Term : VI**  
**Course Name : ELECTIVE PRACTICAL II - ROBOTICS PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Robotics Practical	4	60	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C408.1</b>	<b>Program the Robot offline using Robot Studio</b>
<b>C408.2</b>	<b>Program the Robot online using RAPID</b>
<b>C408.3</b>	<b>Learn on Machine Vision using Lab View</b>

## Course outcomes linkage to Cognitive level:

### Cognitive Level Legend: R- Remember, U- Understand, A- Application

Course Outcome		Linked Expts.	CL	Linked PO, PSO	Teaching Hrs
C408.1	Program the Robot offline using Robot Studio	1,4,8,9,10,12	R/U	PO1, PO2, PSO1	24
C408.2	Program the Robot online using RAPID	2,3,5,6,7,11	R/U	PO1, PO2, PSO1	24
C408.3	Learn on Machine Vision using Lab View	13,14	A	PO7, PSO1	12

### Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Robotics Practical	3	3					1

### Course-PSO Attainment Matrix:

Course Name	Programme Specific Outcomes	
	1	2
Robotics Practical	3	

**Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.**

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## LIST OF EXERCISES

1. Position recording using Cartesian co-ordinate system and Polar co-ordinate system - (No. of positions to be specified)
2. Pick and place the objects – (No. of objects to be specified)
3. Machine loading and unloading practice with time delay - (No. of times to be specified)
4. Determination of robot Work Volume.
5. Writing Program using Digital outputs.
6. Writing Programs using Digital inputs.
7. Pick and stack the objects – (No. of objects to be specified)
8. Spray painting practice - (Area to be specified - 300mm x 300mm)
9. Spot welding practice - (No. of spots to be specified )
10. Arc welding practice – (Length of weld to be specified)

11. Assembling practice - (Simple assembling)
12. Profile cutting offline practice - (Complicated profile – combination of lines and arcs)
13. Practice on Lab View.
14. Color Identification using Lab View.

**Content beyond Syllabus:**

- ✚ Defect Identification using Lab View.

**LIST OF EQUIPMENTS**

- Computer with Accessories : As per requirements  
 Compatible Software : Sufficient quantity  
 Hardware : 6 Axis Robot / Separate Device for the individual task. Teach Pendant control or PC based control through Software

**END EXAMINATIONS**

**Note:** All the exercises should be given and students are allowed to select an exercise by lot.

**Detailed Allocation of Marks for External Assessment**

Part A online programme	40
Part B offline programme	30
Viva-Voce	05
<b>Total</b>	<b>75</b>

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VIRUDHUNAGAR – 626 001

**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1ME409**  
**Term : VI**  
**Course Name : ELECTIVE PRACTICAL II**  
**REFRIGERATION AND AIR CONDITIONING PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Refrigeration and Air Conditioning Practical	4	60	<b>Internal Assessment</b>	<b>End Examination</b>	<b>Total</b>	3 Hrs.
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>CO1</b>	<b>Familiar the basic Refrigeration workshop operation by using various tools.</b>
<b>CO2</b>	<b>Understand the various types of R&amp;AC and proper methods of setting of valves.</b>
<b>CO3</b>	<b>Able to various test procedures and service procedures done on R&amp;AC</b>

### Course outcomes linkage to Cognitive level:

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO	Teaching Hrs
CO1	Familiar the basic Refrigeration workshop operation by using various	Part –A I-a & b	U/A	PO2, PO4, PO7	12
CO2	Understand the various types of R&AC and proper methods of setting of valves.	Part –A 2 & 3	U/A	PO2, PO4, PO7	24
CO3	Able to various test procedures and service procedures	Part – B All	U/A	PO1, PO4, PO7	24

### Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Refrigeration and Air Conditioning Practical	3	3	-	3	-	-	3

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## LIST OF EXERCISES

### **PART- A**

#### **1. BASIC REFRIGERATION WORKSHOP OPERATION**

- (a) Copper and steel tubing  
To study the various sizes of copper and steel tubing.  
To study the various tools used for operations.  
To become familiar with various operations on copper and steel tubing–Flaring, Swaging.
- (b) Soldering methods used in R& A.C

#### **2. TO STUDY THE CONSTRUCTION FEATURES OF THE FOLLOWING:**

- (a) Domestic refrigerators                      (b) Water coolers                      (c) Window Air Conditioner  
(d) Split Type Air-Conditioner

#### **3. PROPER METHODS OF SETTING AND ADJUSTING OF**

- (a) Thermostats  
(b) Low pressure and high pressure cut-outs  
(c) Thermostatic expansion valve  
(d) Automatic Expansion Valve

### **PART-B**

#### **TEST PROCEDURES**

1. To determine the refrigerating effect, C.O.P and the compressor capacity of a open type system with Thermostatic expansion valve, Capillary tube, Automatic Expansion Valve
2. To determine the C.O.P of sealed system by using electrical measurements  
To determine the capacity of a window air conditioner.  
To determine the efficiency of a cooling tower.

Wiring of refrigerator, water cooler, desert cooler, room air conditioner –packaged air conditioner, panel board etc.

#### **SERVICE PROCEDURES**

1. To change refrigerant into service cylinder from storage cylinder.
2. To evaluate the entire system
3. To Pump down the system
4. To Purge air from the system
5. To locate the leaks in a system.
6. To charge the system
7. To check the oil level in the compressor.
8. Tracing the common faults in R& A.C units and their remedies.

## **LIST OF EQUIPMENTS**

### **WORKING MODELS OF THE FOLLOWING WITH ARRANGEMENTS FOR CONDUCTING TESTS**

1. Refrigerator with test rig
2. Water cooler
3. Window A/C with test rig
4. Split A/C
5. Cooling tower

### **WORKING MODEL OF THE FOLLOWING TO CONDUCT EXPERIMENTS**

1. Thermostat units
2. Cut off units
3. Thermostatic expansion Valve unit
4. Automatic expansion valve unit
5. Sealed compressor with experimental setup

### **TOOLS:**

1. Mechanics tool set
2. Tube cutter
3. Tube bender type
4. Tube bender spring
5. Swaging tool
6. Flaring block
7. Flaring nut
8. Pinching tool
9. Capillary tube testing gauge
- 10.

Blow Lamp

### **SERVICE TOOLS:**

1. Gas cylinder with receiver valve and key
2. Charging System
3. Blow lamp
4. Stem key
5. Spring remover
6. Service valve
7. 't' connector
8. High pressure gauge
9. Compound gauge
10. Leak detector, Soldering and brazing kit

## **END EXAMINATION**

**Note:** Examinations will be conducted in both Part A and Part B. Students should be given exercises by selecting one exercise from each part by lot. All the exercises should be given in the question paper and students are allowed to select by a lot.

### **Detailed Allocation of Marks for External Assessment**

1. One Question from Part A	= 25 Marks
2. One Question from Part B	= 45 Marks
3. Viva voce	= 05 Marks
<b>Total</b>	<b>= 75 Marks</b>

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**  
**Course code : N1CO401**  
**Term : VI**  
**Course Name : ELECTIVE PRACTICAL - II**  
**NANO AND SOLAR ENGINEERING PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
Nano and Solar Engineering Practical	4	60	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<b>C401.1</b>	<b>Synthesis and Characterization of Nano material</b>
<b>C401.2</b>	<b>Measure various parameters for understanding PV cell performance</b>
<b>C401.3</b>	<b>Calculate MPP and power flow in AC and DC load</b>

### Course outcome Linkage to Cognitive Level:

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO,PSO	Teaching Hrs
C401.1	Synthesis and Characterization of Nano material	1,2,3,4,5,6	U/A	PO1,PO2,PO4 PSO2	24
C401.2	Measure various parameters for understanding PV cell performance	7,8,9,10,11,12,13	U/A	PO1,PO2,PO4 PSO2	24
C401.3	Calculate MPP and power flow in AC and DC load	14,15,16	U/A	PO1,PO2,PO4 PSO2	12

### Course-PO Attainment Matrix:

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
Nano and Solar Engineering Practical	3	3	-	3	-	-	-

### Course-PSO Attainment Matrix:

Course Name	Programme Specific Outcomes	
	1	2
Nano and Solar Engineering Practical		3

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## **LIST OF EXPERIMENTS**

### **PART – A LIST OF NANO LAB EXPERIMENTS**

1. Preparation of Nano particles using Ball Mill.
2. Synthesis of Nano thin film on one side of substrate by Spin coating method.
3. Synthesis of Nano thin film on two sides of substrate by Dip coating method.
4. Measurement of Nano film thickness using Spectroscopic reflectometer.
5. Measurement of VI Characteristics of Nano film.
6. Comparison of Hydrophobic Characteristics of Natural and Synthetic Nano Materials.

### **PART – B LIST OF SOLAR LAB EXPERIMENTS**

7. Measurement of Solar Radiation using Solarimeter and Lux Meter.
8. I-V and P-V Characteristics of PV module with varying radiation.
9. I-V and P-V Characteristics of series connection of PV modules.
10. I-V and P-V Characteristics of parallel connection of PV modules.
11. Effect of variation in tilt angle on PV module power.
12. Effect of Shading on the output of Solar panel.
13. Working of diode as blocking diode.
14. Power flow calculation of standalone PV system of AC load with battery.
15. Power flow calculation of standalone PV system of DC load with battery.
16. Find the MPP manually by varying the resistive load across the PV panel.

### **PART – C**

1. *Study the operation of a windmill (Not for examination)*

## LIST OF EQUIPMENTS

### NANO ENGINEERING

1	Muffle Furnace
2	Magnetic Stirrer
3	Ultra Sonicator
4	Spin Coating Machine
5	Dipping Machine
6	Spectroscopic Reflecto meter
7	Four Probe Method
8	Contact Angle Meter
9	Digital Weighing Machine
10	Double Distillation Water Still
11	Ball Mill

### SOLAR ENGINEERING

1	Solar panel PV training system	6
2	Infra-red Thermometer	1
3	Luxmeter	2
4	Solar power meter	1
5	Solar Panel 100W(Mono – 1, Poly – 2)	3
6	Inverter (PWM, MPPT – each 1 No.)	2
7	Battery	1
8	Charge Controller 12V / 10A	2
9	DC Voltmeter (MECO make)	6
10	DC Ammeter (MECO make)	6
11	AC / DC Digital tong tester	2
12	Rheostat	1

## END EXAMINATION

**Note:** All the exercise should be given in the question paper and students are allowed to select by lot. (Nano or Solar)

### Detailed Allocation of Marks for External Assessment

Procedure	30 marks
Sketches/Circuit diagram	10 marks
Tabulation	10 marks
Calculation/graph	10 marks
Result	10 marks
Viva – voce	05marks
<b>TOTAL</b>	<b>75 marks</b>

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**N1 - SCHEME**

**Programme : Diploma in Electrical and Electronics Engineering**

**Course code : N1CO403**

**Term : VI**

**Course Name : Elective Practical II – ELECTRIC VEHICLE PRACTICAL**

**TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per Term: 15 weeks

Course	Instructions		Examination			Duration
	Hours / Week	Hours / Term	Marks			
<b>Elective Practical – II</b> <b>ELECTRIC VEHICLE PRACTICAL</b>	4	60	Internal Assessment	End Examination	Total	3 Hrs.
			25	75	100	

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

<i>C 403.1</i>	Assemble the components of Electric vehicle and run it.
<i>C 403.2</i>	Perform test on Drives
<i>C 403.3</i>	Study the characteristics of a battery and execute BMS
<i>C 403.4</i>	Test the MOSFET and Sensors
<i>C 403.5</i>	Study the braking system of Electric Vehicle

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO	Teaching Hrs
C 403.1	Assemble the components of Electric vehicle and run it.	9, 10	R/U/A	PO4,PO7,PSO2	8
C 403.2	Perform test on Drives	14,15	U/A	PO1,PO3,PO4,PO5,PSO2	8
C 403.3	Study the characteristics of a battery and execute BMS	1,2,3,4,7,8	U/A	PO1,PO2,PO3,PO4PO5	24
C 403.4	Test the MOSFET	5,6,13	U/A	PO3,PO4	12
C 403.5	Study the braking system of Electric Vehicle	11,12	U/A	PO1,PO3,PO4,PSO2	8

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
<b>ELECTRIC VEHICLE PRACTICAL</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>1</b>

**Course-PSO Attainment Matrix:**

Course Name	Programme Specific Outcomes	
	1	2
<b>ELECTRIC VEHICLE PRACTICAL</b>		<b>3</b>

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**LIST OF EXPERIMENTS**

1. Conduct experiment for measurement of Volts, Amps and Watts.
2. Study and execute the BMS for given battery.
3. Test the performance of Charger unit
4. Conduct the test for Low/High voltage protection
5. Test the given MOSFET suitable for switching operation
6. Conduct performance test on Hall Sensor
7. Study the Charging characteristics of a given battery
8. Study the Discharging characteristics of a given battery
9. Execute the electrical wiring for lighting of automotive

10. Assemble the components of Electric Vehicle and run it
11. Fix the conversion kit with bicycle.
12. Study the braking system of Electric Vehicle
13. Study and test the brake protection sensor
14. Conduct performance test on controller regulator unit
15. Conduct speed performance test on BLDC Motor
16. \* A model calculation for Electric Vehicle Design

(\* - Content beyond Syllabus)

### LIST OF EQUIPMENTS

S.NO.	NAME OF THE EQUIPMENTS	NO. OF QUANTITY
1.	Electric Vehicle testing kit – work bench model	4
2.	BLDC Motor	1
3.	Controller unit	1
4.	Conversion kit for Hybrid vehicle	1
5.	Lead Acid Battery	1
6.	Lithium ion Battery	1
7.	Hall Sensor	1
8.	Charger unit	1
9.	Low/High voltage protection kit	1
10.	MOSFET testing Kit	1
11.	Ammeter(suitable range)	1
12.	Voltmeter(suitable range)	1
13.	Wattmeter(suitable range)	1
14.	Demo Vehicle - Tri wheeler	1
15.	Demo Vehicle – Two wheeler	1
16.	Miscellaneous Items	As required

### END EXAMINATION

**Note:**

1. Individual equipment should be provided for the batch strength. The same experiment should not be kept more than four students.
2. All the experiments must be given in all the batches.
3. Any one experiment should be given by lot for the End Practical Examination.
4. The external examiner should verify the availability of the equipment for the batch strength before the commencement of Practical Examination.
5. Properly evaluated record note book should be submitted for the End Practical Examination.

**Detailed Allocation of Marks for external assessment**

<b>Sl.No.</b>	<b>Performance</b>	<b>Max. Marks</b>
1.	Drawing diagram/ Writing Details of the Components/Equipments/Machines used	<b>15</b>
2.	Connection	<b>20</b>
3.	Conduction of Experiment	<b>25</b>
4.	Output/Result	<b>10</b>
5.	Viva - Voce	<b>05</b>
<b>Total</b>		<b>75</b>

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**N1 - SCHEME**

**Programme : DIPLOMA IN MECHANICAL ENGINEERING**

**Course code : N1ME320**

**Term : VI**

**Course Name : PROJECT WORK AND SEMINAR**

**TEACHING AND SCHEME OF EXAMINATIONS:**

No. of Weeks per Semester: 15 Weeks

Course	Instruction		Examination			Duration
	Hours/ Week	Hours/ Term	Assessment Marks			
			Internal Assessment	End Examination	Total	
Project Work and Seminar	4	60	25	75	100	3 Hrs.

**Course Outcomes:**

*On successful completion of the course, the student will be able to:*

IN SEMINAR	
C320.1	Develop self confidence and integrity
C320.2	Know the Responsibility of engineer and Understanding Environmental ethics.
C320.3	Know Status of women in India, National human rights commission constitution, and understand Intellectual property rights.
IN PROJECT WORK	
C320.4.	Develop prototype/model of a product.
C320.5.	Enhance team spirit and creative talents for achieving a goal.
C320.6.	Implement the theoretical and practical knowledge gained through the curriculum
C320.7.	Communicate with experts and the community and use their knowledge in developing the project.
C320.8.	Analyze the design of the project to ensure it meets the specifications.

**Course outcomes linkage to Cognitive level:**

**Cognitive Level Legend: R- Remember, U- Understand, A- Application**

Course Outcome		Linked Expts.	CL	Linked PO, PSO	Teaching Hrs
C320.1	Develop self confidence and integrity	-	U/R	PO1	5
C320.2	Know the Responsibility of engineer, Understanding Environmental ethics	-	U/R	PO1,PO2	5
C320.3	Know the status of women in India, and understand Intellectual property rights.	-	U/R	PO1,PO2	6
C320.4	Develop prototype and model of project.	-	A	PO3,PO4	8
C320.5	Enhance team work spirit and team work talent for achieving goals.	-	A	PO6	8
C320.6	Implement the theoretical and practical knowledge gained through the curriculum	-	A	PO1,PO4,PO5	8
C320.7	Communicate with experts and the community and use their knowledge in developing the project.	-	A	PO1,PO6,PO7	8
C320.8	Analysis the design of project to ensure its meets with specification	-	A	PO6,PO7	12
<b>TOTAL</b>					<b>60hrs</b>

**Course-PO Attainment Matrix:**

Course Name	Programme Outcomes						
	1	2	3	4	5	6	7
<b>PROJECT WORK AND SEMINAR</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>

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### **Detailed Allocation of Marks for Internal Assessment - project work and Seminar**

Project Review I & II (VI Terms) (5 + 5)	: 10 Marks
Seminar I & II (5 + 5) = 10 / 2	: 5 Marks
Project report	: 5 Marks
Attendance	: 5 Marks
<b>Total</b>	<b>: 25 Marks</b>

### **END EXAMINATION**

**NOTE:** Viva-voce has to be asked for all the students by the External Examiner and the role of the individual in the team has to be identified.

### **Detailed Allocation of Marks for External Assessment**

<b>S.no</b>	<b>Criteria Component</b>	<b>MARKS</b>
1	Relevance of topic	10
2	Knowledge of methodology	20
3	Role of individual in the team	10
4	Finding of the study	10
5	Viva-voce	25
<b>TOTAL</b>		<b>75</b>